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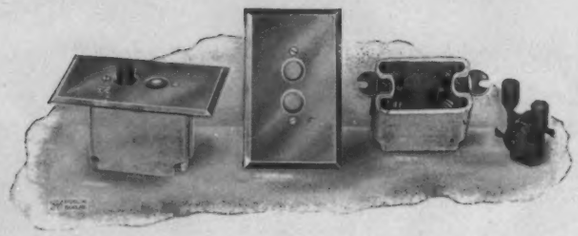

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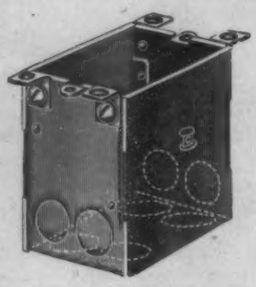

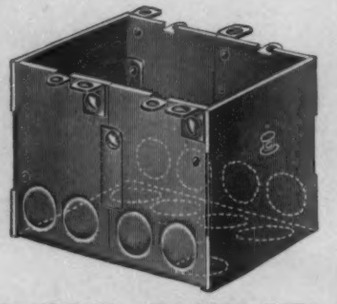

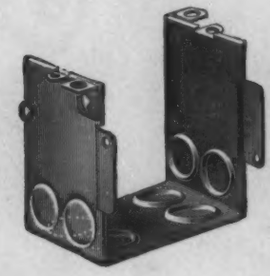

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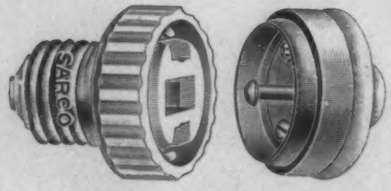

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VOLUME XIX. SAN FRANCISCO, CAL., JULY 13, 1907 No. 2

PACIFIC LIGHT AND POWER COMPANY'S PLANTS AND SUB-STATIONS

San Bernardino Gas and Electric Plant.

The San Bernardino Gas and Electric Co., under the supervision of C. M. Grow, has three water-power plants and two steam plants, the former in the Santa Ana Canyon, Highgrove and West Riverside, or Pedley, while the latter are in San Bernardino, one at Mill Street, and the other at C and Third Streets. A description of the Santa Ana Canyon station, known as the Mentone Plant, appeared in our last issue. At C Street a sub-station and a gas plant, supplying gas to San Bernardino and vicinity, pumping it as far as Highland. The output of gas has been doubled in the last twelve months, and it is supplied at twenty-five per cent less than the other company delivers it.

The Mill Street power house, until recently, was a water-power plant. The water was conveyed by means of a flume from the Santa Ana River to the power house, where it discharged into a single water-wheel unit, direct connected to a General Electric, 2,200-volt generator. This station was destroyed by fire, and it was found that a steam plant would be more satisfactory.

A new power house was built, north of and adjoining the old site, where new foundations were made. One 150-kilowatt, General Electric, three-phase, 2,200-volt generator, with belt-driven exciter, was installed. This generator is belted to one tandem, compound, center-crank, self-oiling Ball engine, 10-inch and 18-inch by 14-inch, 284 revolutions per minute, with 2-ply wheels, 60 inches in diameter and 12-inch face. Another such engine is installed to drive a second generator, if it becomes necessary to put one in. The steam power is generated in two 150-horsepower flue boilers, Atlas and Gem City.

RIVERSIDE POWER HOUSE SHOWING FORE-BAY AND SPILLWAY

A test run was made, and then the plant shut down, as the power was not needed, being used merely as an auxiliary in case of a shut-down for any length of time in one of the near-by power houses.

At the C Street sub-station, there are two 250-kilowatt, oil-insulated, water-cooled, Westinghouse, step-down transformers, from 17,500-volt three-phase to 2,200-volt two and three-phase.

There are two lines between Highgrove and San Bernardino, a high and a low-line, 15,000-volt and 2,300-volt, a great portion of the lighting and motor load being taken off the 2,300-volt line. The lines continue to Riverside, where power is supplied at the car-barn station, off the high line, to the Arlington Railway Company, for the operation of their car line between Riverside and Arlington.

Highgrove Power House.

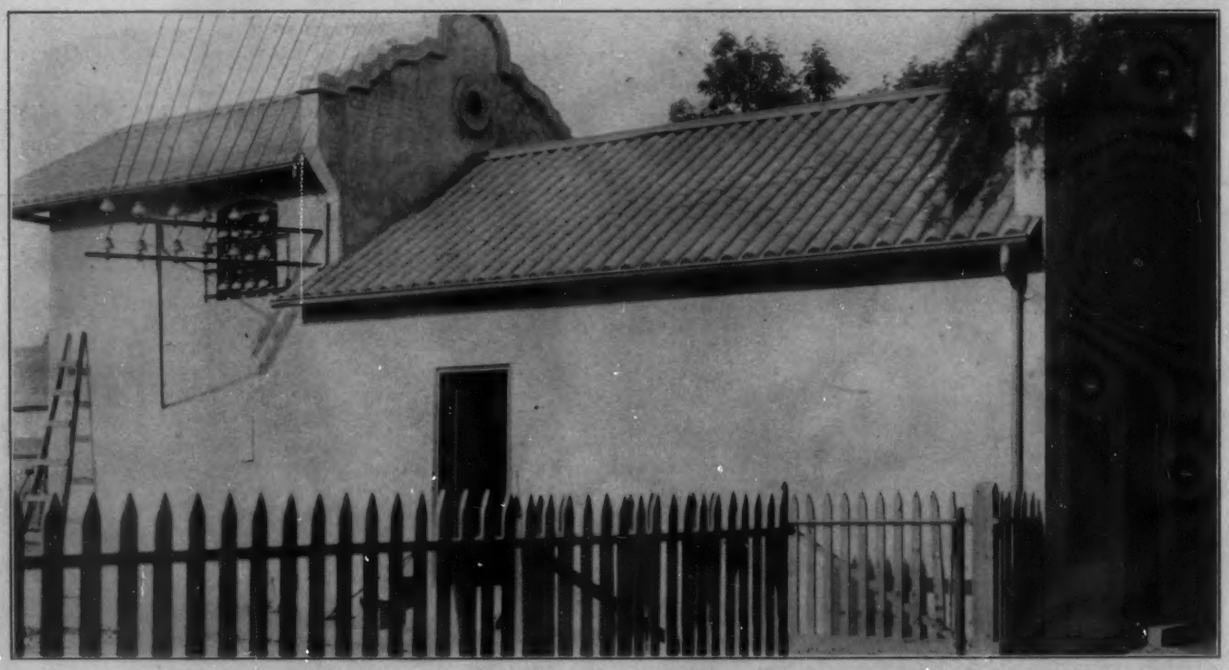
The Highgrove power house it situated one half mile northwest of Highgrove, on the road from that town to Riverside, and, although a small generating station, nevertheless it is one of the most important of the system, as it supplies light and power to a district with a wider range of industrial activities than any other in the South. It was through the efforts of Mr. Garner, superintendent of the station, that several of the small towns are now equipped with a street-lighting system.

Four miles above the power house, one mile east of Colton, a small concrete dam was thrown across Warm Creek, one of the tributaries of the Santa Ana River, this dam including a 30-foot weir, the intake being governed by flashboards. The water is carried south by means of a cement-lined canal as far as the Santa Ana River, where it connects with a wooden flume, which carries the water over the Santa Ana Wash to a cement-lined canal on the other side, which extends southwesterly along the mesa to the small forebay above the power house. This holds 4,500 miners' inches.

The forebay consists of a large stone sand-box with a debris grizzly over the opening to the force main, and a spillway leading to the wasteway below the power house.

The force main consists of riveted steel pipe, six feet in diameter, 200 feet in length, conveying the water to the wheel casing in the basement of the power house. Here are installed two 15-inch cylinder-gate Stilwell Bierce turbines, running 590 revolutions per minute under a 40-foot head. On the main floor of the power house is the generator which converts the hydraulic to electrical energy. It is a General Electric, 150-kilowatt, three-phase, 2,200-volt, 50-cycle generator, belt-driven from the water-wheel units.

There are two 75-kilowatt Westinghouse, oil-insulated, air-cooled, step-up or step-down transformers, 2,300-volt to 15,000-volt. The 15,000-volt line runs to Riverside, while both lines run to San Bernardino. The system is run on either line, or on both. This plant is one of the oldest hydro-electric plants in the State, running continuously in parallel with the other plants of the Pacific Light and Power Co., and are in excellent condition, giving an almost uninterrupted service for light and power. The double-line lead provides, in case of trouble, for the restoration of service immediately by switching. Very often this plant alone has been called upon to provide power for the street-car service in Riverside. A three-panel switchboard is equipped with all necessary meters and switches, oil break switches being used on the 2,300-volt line, and M. & T. switches on the 15,000-volt line.



HOLLYWOOD SUB-STATION PACIFIC LIGHT AND POWER CO.

A system of electric signals and pilot lights have been installed from the forebay to the operating room, thus enabling the operator to determine the flow of water coming into the forebay without leaving the switchboard. It is at this station that most of the operators are broken in for the different power houses of the system.

Riverside Power House.

The Riverside power house, better known locally as the Pedley power house, is twelve miles west of Riverside, on the south bank of the Santa Ana River. This is one of the newest of the Pacific Light and Power Company's plants, having been in operation but three years.

The water for generating the power is diverted from the Santa Ana River at a point where the concrete bridge of the Salt Lake Railway spans the river, and is conveyed by means of a canal six miles to the forebay, just above the power house.

The intake consists of two large head gates, and a wing

FORE BAY—HIGHGROVE POWER HOUSE

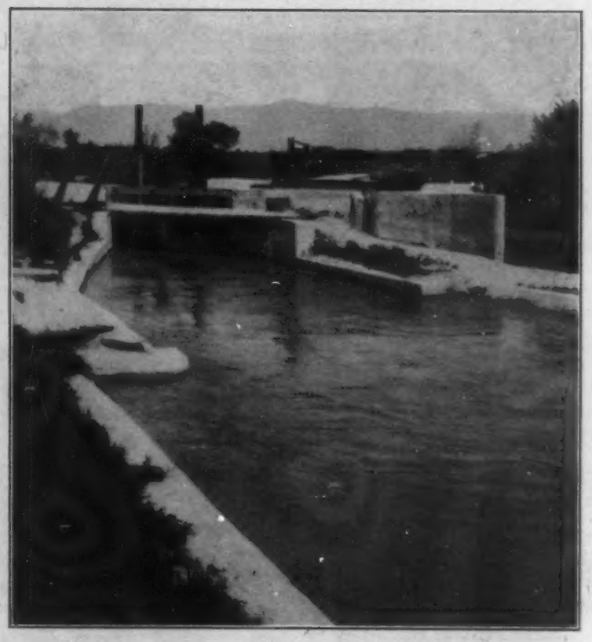
constructed of two-inch tongue-and-groove flooring driven as piling. The wing is outfitted with three flood gates. The canal, with a capacity of over 6,000 miners' inches, is fourteen inches in width at the top, ten feet in width at the bottom, and five feet deep, thus making the angle of the slope one and one-fourth to one. The canal is lined on the top and sides with cement, for the whole distance, and where it passes through sandy soil it is lined on the bottom also, with cement.

The forebay is a small concrete structure, situated on the hillside eighty-seven feet directly above the power house. Grizzlies protect the opening to the force main, and a spillway, which is shown in the cut, conveys excess water to the river below the power house.

The force main consists of two wooden conduits five feet in diameter and 140 feet in length, one conduit supplying water to each of the two units in the power house. These conduits are made of redwood staves, banded by round steel hoops. There are two 36-inch penstocks with automatic relief valves, to protect them from sudden strain, and the gates can be operated by a wire from the power house to the forebay, in case of trouble, to turn the water into the spillway. In the canal system there are five settling basins and six check gates.

HIGHGROVE POWER HOUSE FROM REAR SHOWING WASTE WAY

The power house, sixty feet by thirty feet, is of the latest design, being constructed of concrete, with corrugated-iron roofing. The two side-walls of the main building are reinforced to support a twenty-ton traveling crane, which was installed upon the completion of the walls of the building, and used in all the construction work. In the main building are the water-wheel units, generators, exciters, lightning arresters, and switchboard. The water-wheel units consist of two 22-inch high-pressure Victor turbines, mounted horizontally in spiral cast-iron flume, with quarter-turn discharge, developing 1,000 horsepower, running 500 revolutions per minute, and two units of twelve-inch high-pressure exciter wheels, 1,050 horsepower. Direct connected to the main units are two 300-kilowatt General Electric, 50-cycle, three-phase, 10,500-volt generators, revolving-field type, running 500 revolutions per minute, governed by two Lombard governors, type D. The exciters used are General Electric machines, 136 amperes, 125-volt, run either by separate water wheels or by



HEAD GATES AND CANAL TO HIGHGROVE POWER HOUSE

induction motor, so arranged as to be run by either one or the other. Three 200-kilowatt, air-cooled, General Electric transformers are used to step the voltage down from 10,000-volt, three-phase, to 2,300-volt, three phase. These latter are located at the Riverside sub-station, supplying light and power to Riverside.

This plant was originally built and operated by Mr. Pedley, of Riverside, under the supervision of Mr. S. W. Allum, and was purchased by the Pacific Light and Power Company about a year ago. It has been running as an isolated plant, supplying energy to Riverside, until recently, when an addition of a 14-foot by 16-foot room was made to the main building, in which were installed three 200-kilowatt, oil-insulated, water-cooled, three-phase, Stanley transformers, stepping the voltage from 10,500 to 17,500, to parallel the plant with the others of the Pacific Light and Power Company. It was tied in at Riverside, on the high line from Riverside to San Bernardino.

There is a five-panel switchboard, provided with all modern instruments and circuit breakers, and two 15,000-volt, three pole, hand-controlled, Kelman oil switches. Six General Electric, 10,000-volt, lightning arresters are mounted in the building, to the right and above the switchboard. The plant has been running for three years without a shut-down of over six hours at a time for any break-down on the machines, and

has proven a valuable asset in the company's system of plants.

Kern River Sub-Station.

This sub-station is located on Mission Road just east of Eastlake Park, where the new concrete bridge on the Pasadena short line of the Pacific Electric Company spans Mission Road. It is a modern 3-story building constructed of reinforced concrete and outfitted with the latest apparatus.

Each Kern line enters the station on the third floor in a separate gallery. The main line's 60,000 voltage is stepped down to 15,000 by means of four banks of three 150-kilowatt, General Electric transformers, oil insulated and water cooled, so arranged that each bank can be cut in on either or both lines. The transformer leads are brought from each bus into a 60,000-volt Kelman oil switch of the 3-phase design, then from the oil switch to a selector, or open-air knife blade, 6000-volt switch, single-pole design, made in the company's shop. From the selector the leads go straight to the transformers, which are located on the ground floor, each bank in a separate fireproof room. Each line has a bank of General Electric lightning arresters connected to it through a Kelman 60,000-volt oil switch, and then through a selector switch. Each line may be shorted and grounded by throwing the lightning arrester selectors over to a reverse position into three jaws, which are grounded and shorted. The bus galleries are located on the second floor. The 15,000-volt terminals are brought up through selector switches and 15,000-volt Kelman oil switches to either or both of two separated buses contained in separate galleries and known as a front and rear bus, which are duplicates, either or both available. Each bus is connected to a corresponding front and rear bus belonging to the Los Angeles Railway Company through a 15,000-volt Kelman oil switch, each of which is contained in a separate fireproof gallery. The above company has two lines leaving from these buses, which can be cut in on either or both buses, through selector and a 15,000-volt oil switch of the same make and design as the Kern buses.

In the same galleries with, but in no means connected to, the Los Angeles Railway Company's buses are two buses belonging to the Pacific Electric Railway Company, fed from a main line to the steam plant belonging to the latter company connected to the P. L. & P. Company's line the same as the Los Angeles Railway Company's feeder lines, i. e., each wire through a selector switch, then the three through a 15,000-volt, 3-phase Kelman oil switch. They have five lines feeding off these buses to their different sub-stations and can be run in synchronism with the Kern system, which is the usual operating condition during the most of the day. Los Angeles Railway Company has no alternators, so there is no occasion to parallel.

The Pacific Light and Power Company have two separate buses, each contained in a separate fireproof room or gallery and connected through an oil switch to each Kern 15,000-volt bus. Their water-power plants feed into either of these buses and then out again to their sub-station and steam plant at Third and Los Angeles Streets. From one of these buses they have the connection with the Pacific Electric Company's bus, so they can parallel that system.

KERN SUB-STATION—PACIFIC LIGHT AND POWER CO.

Two 625-kilowatt transformers connected through oil and selector switches to the Pacific Light and Power Company buses supply station lights, two local 2200-volt circuits for residence lighting, and two 2200-volt circuits for power purposes. Nine municipal arc circuits are also fed from this station.

The main ground floor of the building is taken up as an operating room, containing the arc regulators, 2200-volt switchboard, and the instrument boards for the 60,000- and 15,000-volt line. There is a three-phase ammeter on each bank of transformers on the 60,000-volt side.

The operating table is also located in this room, having a specially made 3-way valve for each switch, which admits compressed air to a cylinder under eighty pounds pressure and opens or closes the switch. The oil switches are all controlled by compressed air, which is kept up to pressure

in a storage tank by means of a small motor-driven air compressor, arranged to automatically cut in or out, thereby keeping a constant pressure without continually running.

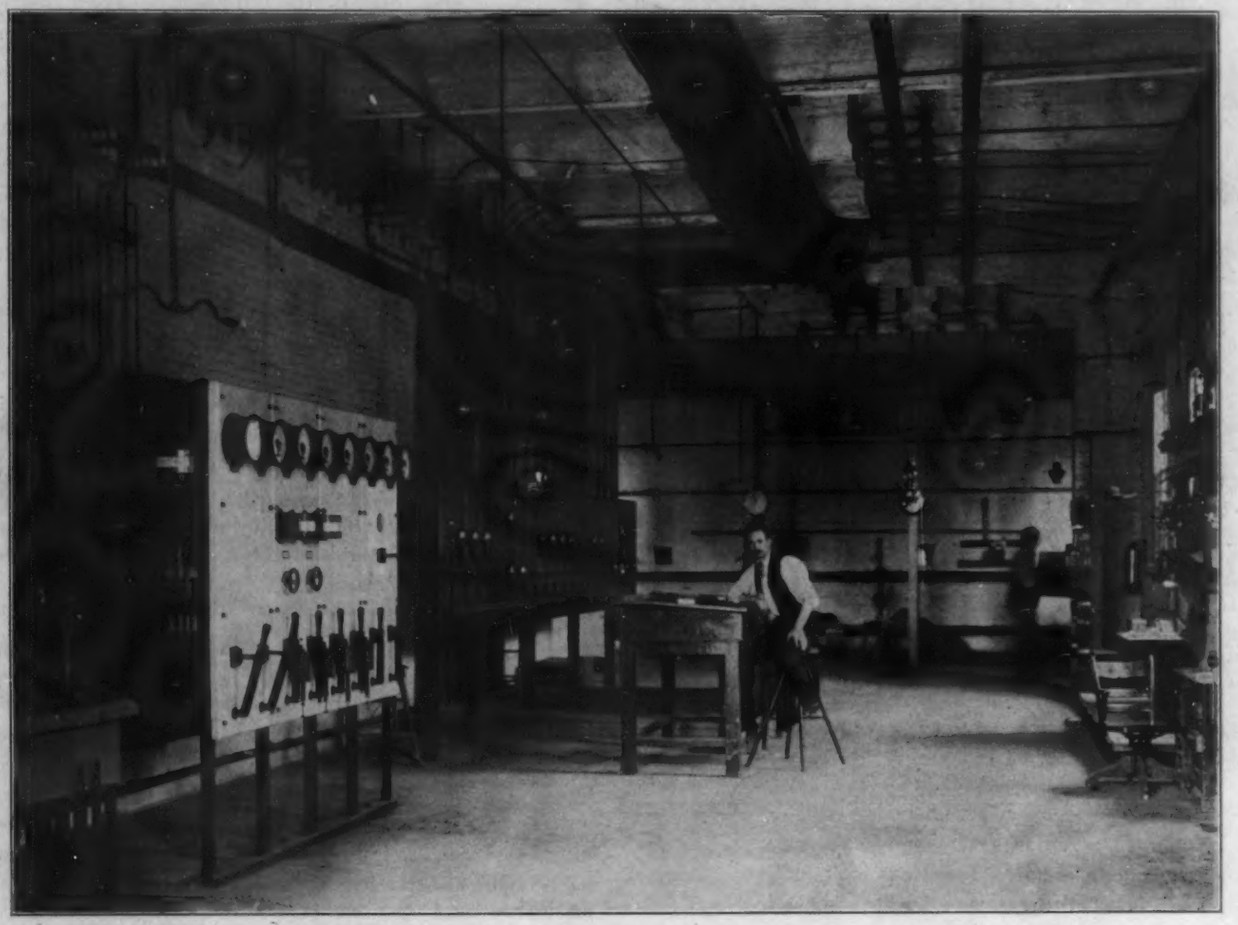
Los Angeles Steam Plant.

This steam plant, belonging to the Pacific Light and Power Company, is located at Third and Los Angeles Streets, Los Angeles, in the same building with the sub-station. It was started as a small plant in the late nineties, but the capacity has been increased yearly since the first installation.

Installed in this plant are several steam units with their separate banks of boilers, one 2400-horsepower McIntosh & Seymour condensing, cross-compound, gridiron-valve, horizontal engine, 28-in. and 58 in. by 48 in., direct connected to one 1500-kilowatt, revolving field, 2-phase, 2400-volt, 50-cycle, Bullock generator, revolving 120 revolutions per minute, is one of the latest installation, together with a similar engine, 1150 horsepower, direct connected to a 750-kilowatt Westinghouse generator of the same type as the Bullock generator mentioned above. There is one 700-horsepower Hamilton-Corliss non-condensing simple engine, 28½x60 inches, 73 revolutions per minute, belted to one 300-kilowatt, Westinghouse, 2-phase, 2400-volt, 50-cycle generator, running 300 revolutions per minute. There are two 300-kilowatt, Westinghouse, 2-phase, 2400-volt, 50-cycle generators, 300 revolutions per minute, one belt driven by a 600-horsepower Hamilton-Corliss engine, 28½x60 inches, 73 revolutions per minute, and the other rope driven by a 600-horsepower engine of the same type, 30x48 inches, 66 revolutions per minute. Two other McIntosh & Seymour engines were installed, one driving a Bullock generator and the other a Northern generator. The first engine is 100-horsepower condensing, tandem compound, piston valve, horizontal, 9-in. and 16-in. by 12 in., while the second is 85-horsepower, same type, 8-in. and 16 in. by 12-in. The Bullock generator is a 75-kilowatt, multipolar, 125-volt, direct-current machine, running 275 revolutions per minute, and the Northern generator is a 65-kilowatt, multipolar, 125-volt, direct-current generator, running 250 revolutions per minute.

Four separate banks of boilers are arranged as follows: One bank of three 500-horsepower B. & W. boilers, one bank of three 355-horsepower Stirling boilers, one bank of two 250-horsepower Stirling boilers, and one bank of two 200-horsepower Stirling boilers.

The sub-station in the same building was installed and started in the spring of 1898. At that time there were installed two 150-kilowatt, Westinghouse, oil-insulated, water-cooled transformers, stepping the voltage down from 15,000, 3-phase, to 400 volts, 2-phase, connected to one 250-kilowatt, Westinghouse, 500-volt, direct-current, 50-cycle, compound-wound rotary converter, running 500 revolutions per minute; and the same year two 125-kilowatt transformers of the same type, stepping the voltage down to 200 volts, 2-phase, from 15,000 volts, 3-phase, connected to a 225-kilowatt rotary converter of the same type as the above, were put in. In 1899 two 250-kilowatt transformers, 15,000 to 200 volts, were installed, connected to a 400-kilowatt, 250-volt converter, and in 1900 two more transformers were put in and another converter, 400 kilowatts. From 1902 to 1904 six more transformers were put in. These were 625-

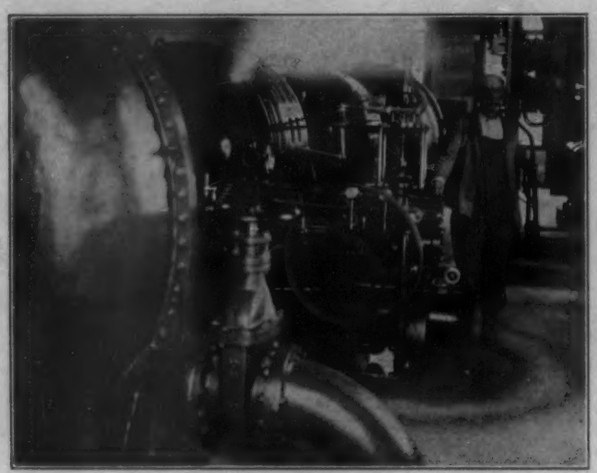


INTERIOR KERN SUB-STATION

kilowatt, Westinghouse, oil-insulated, water-cooled, 50-cycle, step-up or step-down transformers, 2400-4800 volts, 2-phase, to 15,000-16,000 volts, 3-phase. In January of 1906 two more transformers, same as above, were installed, connected to fifteen 5000-volt arc circuits and to 848 Western Electric and Manhattan lamps through Manhattan regulators. The switches, twenty-one in number, are the 3-pole, 15,000-volt, Kelman oil switches, hand controlled. The system is protected by six Westinghouse 18,000-volt lightning arresters.

Of the other sub-stations around the city the accompanying cut of the Hollywood is typical of the rest, as most of them are built Mission style, Sunnyslope being the exception. This is a corrugated-iron building and was installed in 1903. In it are two 150-kilowatt, Westinghouse, oil-insulated, water-cooled, 50-cycle transformers, 15,000-volt, 3-phase, to 2400-volt, 2-phase, connected to two 2-phase, 2400-volt power circuits for operating pumps.

The oldest sub-station is the one known as the South Pasadena sub-station. This was installed in 1899, the present building having been constructed in 1906. Here are installed two 125-kilowatt, Westinghouse, oil-insulated, water-cooled, 50-cycle transformers, stepping the voltage from 15,000, 3-phase, down to 2400, 2-phase, connected to three 2-phase commercial light and power circuits and



INTERIOR RIVERSIDE POWER HOUSE

operating two 50-horsepower, 2400-volt induction motors, direct connected to a 100-kilowatt, 500-volt, D. C. generator, supplying 500-volt power for Pasadena.

The University sub-station, the next one installed, was built of brick and concrete in 1900. This is one of the largest of the company's sub-stations around the city, containing two 300-kilowatt, Westinghouse, oil-insulated, water-cooled, 50-cycle, step-down transformers, 16,500-15,000 volts, 3-phase, to 2400-4800 volts, 2-phase, connected to eight 5000-volt arc circuits through Manhattan regulators and to 445 Western Electric and Manhattan lamps. The switching apparatus consists of six 3-pole, 15,000-volt, hand-controlled, Kelman oil switches.

The last sub-station to be installed was the one at Hollywood, built in 1906. The voltage is stepped down here from 8750 or 17,500 to 2500 or 10,000 volts, for local power and lighting, by means of two 200-kilowatt, oil-insulated, water-cooled, 50-cycle, Stanley transformers.

COPPER MARKET SITUATION.

The present copper market situation is a decidedly waiting one, says Copper Gossip, and very little new business is being placed. Producers and consumers are resting on their oars, and have apparently settled down for a leisurely test of endurance. Out of the long-drawn-out hesitation displayed by buyers there has come the impression that prices for copper must come down to a level where demand will start up anew. The withdrawal of big consumers from the market has put sellers on the defensive, and although leading producers continue to quote the old figure of 25¼ for electrolytic wire bars, the amount of trading at that price is either practically nil or reduced to exceedingly narrow proportions. Quotations of 22½@23 for some grades of electrolytic are made in other quarters, and this fact tends to further mix up a peculiar situation. But no matter what price is quoted, there is no disposition to trade on a heavy scale.

It is evident that the majority of sellers are intent upon maintaining prices until deliveries against old contracts are completed, or nearly so. In this way buyers may be pretty well protected from wholesale changes until they evince a desire to enter into new engagements. If, however, the delay in purchasing should be spun out for another month or two longer, the question of market support will become a more serious problem than that encountered at any time this year. Consumers are in the position where they need considerably more assurance of market stability than is possible under present circumstances before they will stock up freely with new supplies of copper. On the other hand, if conditions preclude this assurance concessions in price will probably be necessary to bring buyers into the market. There must be some way found to break the existing deadlock.

It does not require a very sagacious observer to understand that during all the long period of cautious proceedings which has characterized the action of consumers lately matters have been getting into a much more healthy condition in many parts of the country. Stocks of wire and finished goods have been worked off, and the result is new orders must be filled, in many cases direct from the factory where they are for important quantities. A revival in business would make a big difference with manufacturers and machinery would soon be kept busy again once the inducement is extended to fill up the empty shelves with fresh stock. The fact that production for the first half of this year falls well below that for the first half of 1906 is another feature in the situation that should tend to prevent expectations of a too radical reaction in the copper market. There have been many circumstances used as bear arguments recently, but normal conditions in financial circles, with consequent ease in money and fairly good crops would quickly dispel the notion that we were to suffer any general business depression. As for copper, what is needed is a readjustment of the market to correspond with actual trade conditions. Market elasticity in harmony with developments is the solution for keeping the world's industries hopefully busy. We are not on the pessimistic side of the fence as to the future outlook for business, but we believe in meeting conditions as they arise in a way that will tend to establish trade and credit on the soundest possible basis.

CODE OF ETHICS FOR ELECTRICAL ENGINEERS.

At the recent meeting of the American Institute of Electrical Engineers held at Niagara Falls on June 28, a committee, consisting of Charles P. Steinmetz, Harold W. Buck, and S. S. Wheeler, chairman, presented a report embodying a proposed code of engineering ethics, which is printed below. The committee stated that while it did not consider it practicable at this time to formulate a code of ethics covering explicitly all the conditions which the electrical engineer may meet in his work, it did consider it both practicable and desirable to record some of the general principles of professional conduct that should be a guide for the electrical engineer, leaving it to him to make specific application to the cases which he may meet.

General Principles.

1. In both his professional and his business relations the electrical engineer should follow strictly the same ethical principles that are recognized in the social relations of everyday life. He should consider himself personally responsible for the character of the enterprises and the persons with which he is associated professionally.

2. Before entering into professional relations, it is therefore the duty of the electrical engineer to satisfy himself that the enterprises with which he connects himself are of a legitimate character. If, after becoming associated, he finds them to be of a questionable nature, he should sever his connection as soon as possible. It should not be considered an excuse that his connection extends only to legitimate engineering work.

3. An electrical engineer permitting the use of his name in any enterprise or exploitation becomes morally responsible for the character of the latter. He should therefore not allow the use of his name in connection with anything upon which he is not qualified by training and experience to exercise competent judgment.

4. The electrical engineer should take care that credit for engineering work is attributed to those who, as far as his knowledge of the matter goes, are the real authors of such work.

5. The electrical engineer should incline toward and not away from standards of all kinds, since standardization is peculiarly essential to the general progress of the profession. This applies to construction, measurement and expression, or nomenclature, as well as to conduct or ethics. Even the tendency to give individuality by providing special construction may sometimes be avoided with advantage.

Relations of the Electrical Engineer to His Employer, Customer, or Client.

7. The electrical engineer should consider the protection of his client's interests as his first obligation, and therefore should avoid every act that would be contrary to this duty; if any other consideration, such as professional obligations or restrictions, interfere with his so acting in accordance with the expectation of his client, he should inform him of the situation.

8. He can honorably accept compensation, financially or otherwise, from one side or party only, interested in the same matter. The electrical engineer, whether consulting, designing, or operating, may therefore not accept commissions, either directly or indirectly, from other parties dealing with his principals.

9. Electrical engineers in a position to decide on the use of inventions, apparatus, etc., should not be financially interested in their use, as by receiving a royalty, etc., unless the matter is clearly understood by the client.

10. Electrical engineers should not accept employment while financially interested in a rival concern, except upon the express permission of both parties. An electrical engineer may be employed by more than one party, as in the case of a consulting engineer, when the interests of the parties do not conflict, and it is understood, as is usual in such cases, that he is not expected to devote his entire time to the work of one party, but is free to engage into other engagements. A consulting engineer permanently retained by a party should notify other prospective employers of this affiliation before entering into relations with them. A consulting engineer, when not exclusively retained by one side, may advise rival concerns, with the full knowledge of all of them and upon taking care that the interests of the parties do not conflict in the particular matter handled.

11. Operating engineers should consider themselves responsible for defects in apparatus or dangerous conditions of operation, should bring the same to the attention of their employers and urge remedial action. If the causes of the danger are not removed they should withdraw.

12. An electrical engineer should in general be considered directly responsible to his employer or client for the successful fulfilment of the work upon which he has been engaged and for its satisfactory performance as a whole. It should therefore be clearly understood at the outset just what the extent or the limitations of responsibility of the engineer are to be. Whether he has been employed merely as designer or whether he is retained to design and to superintend construction; whether to design only the chief features, or to pass as well upon all details of the apparatus that is to be installed. Attention should be directed to the fact that defects in the manufacture of material or apparatus is a matter distinct from the matters of design or installation. An engineer should not be held responsible for the unsatisfactory performance of a plant resulting from defective apparatus furnished, unless he has undertaken to include this subject.

Relations of the Electrical Engineer to the Ownership of the Records of His Work.

15. The following general principles should be recognized:

If, in executing his work, the electrical engineer uses data or information which are not common and public property, but which he receives, directly or indirectly, from his employer, or if the problem solved by the engineer is met in the pursuit of his work for his employer and is not of such character that his attention would have been directed to it regardless of his relations to his employer, the products of his work, in the form of inventions, plans, designs, etc., are not his private property, but the property of his employer, though the engineer may be entitled to special remunerations for such inventions, etc.

16. If, in the execution of the work, the engineer uses only his own knowledge or data or information which are public property by prior publication, etc., and receives no engineering data from his employer or customer, except performance specifications, the results of the work, such as inventions, plans, designs, etc., are the private property of the engineer, and his employer or customer is entitled to their use only in the specified case.

17. All the work done by the engineer in the form of inventions, plans, designs, etc., which are outside of the field of engineering for which his employer has retained him, are the engineer's private property.

18. When an engineer or manufacturer builds apparatus from engineering designs supplied to him by his customer, the designs remain the property of the customer and should not be duplicated for other customers without express permission. When the engineer or manufacturer and his customer are jointly to work out designs and plans or develop inventions, a clear understanding should be arrived at before the beginning of the work regarding the proportionate rights of ownership in any inventions, designs, etc., that may result, since in such case both parties should be considered to have rights therein.

19. Any engineering data or information which an electrical engineer obtains, directly or indirectly, from his em-

ployer or customer, or which he creates as a result of such information, must be considered by the engineer as confidential; and while the engineer is justified in using such data or experience in his own practice as going towards his education, the publication thereof without express permission is improper, as is also its use in producing for other parties work that is characteristic of the original customer or employer.

20. Designs, data, records and notes made during his engagement by an engineer employed under permanent engagement, and referring to his work, are his employer's property. The same matter in the case of a consulting electrical engineer are the property of the consulting engineer.

21. A customer, in buying apparatus, does not acquire any right in its design beyond the use in the apparatus purchased. A customer of a consulting engineer does not acquire any right to the plans made by the consulting engineer except for the specific case for which the apparatus was built or the plans made.

Relations of the Electrical Engineer to the General Public.

22. The electrical engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, spread the general knowledge of electrical engineering, and discourage wrong or exaggerated statements on engineering subjects published in the press or otherwise, especially if these statements are made for the purpose of, or may lead to, inducing the public to participate in unworthy schemes.

23. Controversies on engineering questions, however, should never be carried on in the public press, but should be confined to the technical press and the engineering societies.

24. First publication of inventions or other engineering advances should not be made through the public press, but rather through the technical press and the engineering societies.

25. The publications which an electrical engineer is justified in making through the public press should therefore be of a historical, educational, instructive or similar character and should not relate to controversies between engineers or on engineering questions, to new inventions, etc., nor contain technical criticisms of fellow engineers, and it should be considered unprofessional to give opinions without being fully informed on all facts relating to the question, and on the purpose for which the opinion is asked, with a full statement of the conditions under which the opinion applies.

26. In giving expert testimony before judicial bodies, the electrical engineer should confine himself to brief and clear statements on engineering or historical facts. He should not give personal opinions without so expressly stating, and should avoid pleading on one side or the other.

Relations of the Electrical Engineer to the Engineering Fraternity.

30. The electrical engineer should take interest in and show due regard for the electrical engineering societies and the technical press.

31. He should assist his fellow engineers by exchange of general information, experience, instruction, etc.

32. He should not take a position left by another electrical engineer without satisfying himself that the former has left it voluntarily, or for proper reasons.

33. Where engineering work is in charge of an electrical engineer, no other electrical engineer should undertake the work except on request of or in co-operation with the electrical engineer who had charge of the work before, unless the latter's connection with it has already terminated.

34. An electrical engineer in responsible charge of work should not permit other engineers or non-technical persons to over-rule his electrical engineering decisions. If this is done and persisted in, he should as soon as is practicable withdraw.

35. In engineering work in charge of a board of engineers, the respective limitations of the authority of each should be decided at the outset, and each electrical engineer should give full and complete information on his part to the other engineers and insist on this being reciprocated.

Relations of the Electrical Engineer to the Standards of His Profession.

40. The title "electrician" should be applied to those having practical training sufficient to enable them to carry on intelligently certain classes of electrical work, such as the installation of electric lights, signalling systems, and the operation of small electric plants.

41. The title "electrical engineer" should be applied only to graduates from the electrical engineering schools of universities of recognized standing, and such men as possess an equivalent knowledge of electrical engineering.

42. The title "consulting electrical engineer" should be applied only to those electrical engineers who possess such knowledge and experience in electrical engineering as would qualify them to full membership in the American Institute of Electrical Engineers.

NATIONAL ELECTRICAL CODE.

The National Electrical Code was originally drawn in 1897 as the result of the united efforts of the various insurance, electrical, architectural and allied interests which, through the National Conference on Standard Electrical Rules, composed of delegates from various national associations, unanimously voted to recommend it to their respective associations for approval or adoption.

The following is a list of the associations composing the National Conference on Standard Electrical Rules:

American Institute of Architects.
American Institute of Electrical Engineers.
American Society of Mechanical Engineers.
American Institute of Mining Engineers.
American Street Railway Association.
Associated Factory Mutual Fire Insurance Companies.
Association of Edison Illuminating Companies.
International Association of Fire Engineers.
International Association of Municipal Electricians.
National Board of Fire Underwriters.
National Electric Light Association.
National Electrical Contractors' Association.
Underwriters' National Electric Association.

GENERAL SUGGESTIONS.

In all electirc work, conductors, however well insulated, should always be treated as bare, to the end that under no conditions, existing or likely to exist, can a ground or short circuit occur, and so that all leakage from conductor to conductor, or between conductor and ground, may be reduced to the minimum.

In all wiring, special attention must be paid to the mechanical execution of the work. Careful and neat running, connecting, soldering, taping of conductors, and securing and attaching of fittings, are specially conducive to security and efficiency and will be strongly insisted on.

In laying out an installation, except for constant-current systems, every reasonable effort should be made to secure distribution centers located in easily accessible places, at which points the cut-outs and switches controlling the several branch circuits can be grouped for convenience and safety of operation. The load should be divided as evenly as possible among the branches and all complicated and unnecessary wiring avoided.

The use of wire-ways for rendering concealed wiring permanently accessible is most heartily endorsed and recommended, and this method of accessible concealed construction is advised for general use.

Architects are urged, when drawing plans and specifications, to make provision for the channeling and pocketing of buildings for electric light or power wires.

TRANSFORMER TESTING FOR CENTRAL STATIONS.*

The financial success or failure of a lighting or power plant is measured by the efficiency of the machinery, and means and methods for the determination of efficiency thus become of special interest to the central station manager. The efficiency of the plant depends upon that of each piece of apparatus of which it is composed. In alternating current distribution the transformers are frequently scattered in large numbers throughout the system, and their cumulative losses, forming a large part of the total energy wasted in the system, greatly affect the efficiency.

In many cases, tests of transformers have not been made, owing to the expense and labor involved or to be lack of the necessary knowledge. Instructions are given in this article for the few simple tests required for the determination of transformer characteristics with the use of instruments and apparatus available at a central station.

The characteristics of a transformer may be completely determined by the following tests:

(1) Insulation test.
(2) Measurement of core loss and exciting current.
(3) Measurement of resistance.
(4) Measurement of impedance.
(5) Heat test.
(6) Ratio and polarity test.

Regulation and efficiency may be calculated from the results of (2), (3), and (4).

Insulation Test.

The insulation of transformers should be given the following tests:

(1) Between primary and all other parts.
(2) Between secondary and all other parts.

The Transformer.

The testing transformer may be of constant ratio with some form of regulating device in the primary, or it may be self-regulating.

If the transformer is of constant ratio the regulation should be obtained by the use of a device on the low tension side which will raise the voltage gradually, such as a continuous circuit rheostat, a water rheostat, a continuous circuit reactive coil or an induction regulator. It is not permissible to use a form of regulating device in which the increase in voltage is obtained in steps, such as a dial switch regulator or step by step rheostat.

Care must also be taken in the wiring and connections, so that there is no possibility of the occurrence of an open circuit.

These precautions are essential, for either an open circuit in the connections or a sudden change in voltage is liable to produce an inductive kick resulting in a voltage strain much more than that indicated by instruments.

Control of the voltage by resistance in the primary of the testing transformer (Fig. 1) is fairly satisfactory, but is open to objection for the reason that in order to take care of all conditions it is necessary to provide sufficient resistance for minimum current and carrying capacity for maximum current. This may, in part, be overcome by series multiple coupling of the resistance.

The use of resistance control is also liable to produce wave form distortion, resulting in a "peaked" wave of EMF on the secondary. This is not a serious objection if the instructions with reference to the use of the spark gap in shunt are carefully followed.

When the testing transformer is of sufficient size to warrant the expense, an induction regulator gives an ideal method of control, since the regulation is obtained by changing the relative positions of the armature and field and there are consequently no steps but a gradual variation of voltage.

* Bulletin 8317 General Electric Co.

If the primary winding of the testing transformer is designed for double that of the supply circuit, the kilowatt capacity of the regulator need be only one-half that of the testing transformer in order to obtain full range regulation from zero to the maximum voltage of the testing transformer, and often a still smaller regulator will give as great a range of control as desired.

Since the action of such a regulator does not depend on the flow of current through it as do a resistance or reactance, it will regulate closely for all conditions of load within the capacity of the transformer, while resistance or reactance in order to give the same range must have, either inherently or by series multiple connection, sufficient impedance to absorb the voltage at minimum current as well as sufficient carrying capacity for the maximum current.

Under certain conditions, i. e., when the amperes delivered to testing transformers are small compared to the capacity of the machine, it is permissible to control the voltage on the primary of the transformer by varying the field excitation of the machine (Fig. 2).

When, however, a generator of sufficient capacity is not available, this method should be avoided, as severe wave form distortion is liable to result.

A convenient form of regulating transformer has recently been introduced which recommends itself by reason of the easy and perfect regulation which is obtained. This transformer employs a magnetic shunt by means of which more or less of the magnetic flux generated by the primary winding is allowed to thread the secondary coil. The magnetic shunt is easily moved by means of a hand wheel and not only permits a wide range of regulation but allows an even variation throughout this range. The connections for this method are shown in Fig. 3.

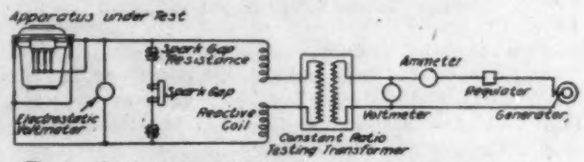


Fig. 1.—Insulation Test with Constant Ratio Testing Transformer. Voltage controlled by resistance in primary of Testing Transformer.

The design of this transformer is such that low reactance between primary and secondary is not readily obtainable. This is an advantage rather than otherwise, for should it be used on a generator having a seriously peaked wave this reactance effectually modifies the wave to one much nearer a sine curve.

Spark Gap.

The shape of the wave of the E. M. F. applied is a very important factor in all high voltage testing, and it is the recommendation of the American Institute of Electrical Engineers that insulation tests be made with a sine wave of E. M. F., or where this is not available at a voltage giving the same striking distance between needle points in air as a sine wave of the specified E. M. F.

An indicating voltmeter or an electrostatic voltmeter indicates effective values of voltage, whereas the insulation strain depends on the maximum point in the voltage wave and not on the effective value.

There is no fixed relation between the two, but for a given effective voltage the maximum voltage may vary between wide limits. The spark gap is therefore the ultimate standard to which the voltages should be referred, and when an electrostatic voltmeter is used, or the ratio of transformation is depended upon to indicate the test voltage, they should be frequently calibrated with the spark gap to determine the equivalent sine wave. It is important that this calibration be made under conditions of test while the testing transformer is loaded with the apparatus under test.

On the other hand, since it is inconvenient to reset the spark gap with new needles after each test, it is recommended that the apparatus under test be shunted by a spark gap set for a voltage ten per cent in excess of that to be applied. The voltage should then be increased gradually until the electrostatic voltmeter indicates the desired voltage. The spark gap will not discharge unless the desired voltage has been exceeded by ten per cent, and in that case will serve to protect the apparatus from excessive strain.

For needles, new sewing needles should be used, and they should be renewed after each discharge, no matter how slight, since the slightest arc will tend to dull the needle point and change the potential required to jump across the gap.

Spark Gap Resistance.

Whenever a spark gap discharges, transient oscillations of extremely high frequency and dangerous magnitude may be set up which are liable to injure the testing transformer as well as the apparatus under test, unless measures are taken to guard against this tendency.

The magnitude of these oscillations varies with the capacity constants of the devices under test, the voltage at which

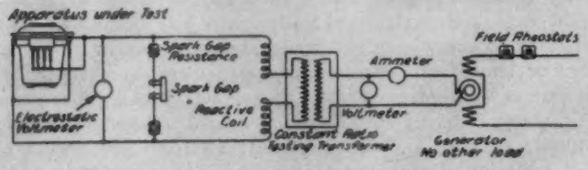


Fig. 2.— Insulation Test with Constant Ratio Testing Transformer. Voltage controlled by field rheostats in generator.

the tests are made, and the current passing in the gap.

It is therefore essential that graphite rods or other high resistance be placed in series with the spark gap (Figs. 1 to 3), to reduce the magnitude of these oscillations.

A resistance of about one-half ohms per volt should be used in series with each terminal of the spark gap so as to keep the discharging current between the limits of one-quarter and two amperes.

Line Reactive Coils.

As a further protection to the testing transformer it is desirable on the higher voltages to use reactive coils in series with the line to choke out the oscillations due either to a discharge across the spark gap or a break-down of the insulation under test. At 10,000 volts or less such reactances are hardly necessary.

Electrostatic Voltmeter.

Although the only absolute method of measuring the peak of the voltage is by means of the spark gap, it is nevertheless undesirable, when making a test, that there should be a discharge across the gap. It is therefore customary to employ an electrostatic voltmeter connected across the apparatus under test. Since, however, the electrostatic voltmeter measures effective rather than maximum voltage its indications are correct only with a sine wave of E. M. F., and in making high potential tests its reading should never be taken as absolute.

In using an A. C. voltmeter on the low-tension side of the testing transformer the ratio of transformation must also be taken into account. As electrostatic voltmeters are not available for use on more than 60,000 volts, this method of measuring voltage above that amount must be used, notwithstanding the objections cited, unless a potential transformer in conjunction with an A. C. indicating voltmeter is used. This latter apparatus forms a very desirable substitute for either of the above methods, and, while somewhat more expensive, is strongly recommended.

The potential transformer is connected directly across the apparatus under test and gives a measurement of the impressed voltage which is independent of any change in ratio of the testing transformer.

Figs. 1 to 3 are diagrams of connections for testing the insulation between the primary and secondary. Connections for testing the insulation between the primary and core, or between the secondary and core, are similar.

In testing between the primary and secondary, or between the primary and core and frame, the secondary must be connected to the core and frame, to avoid statically induced strains.

It is important that all primary leads should be connected together, as well as secondary leads, in order to secure throughout the winding a uniform potential strain during the test.

The following order should be observed in making the test:

(1) Set the spark gap for a voltage ten per cent in excess of that which is to be applied.

The distance at which the needle points should be set should be determined from the standard spark gap curve of

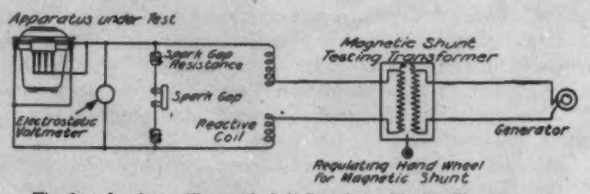


Fig. 3.— Insulation Test with Self-Regulating Testing Transformer.

the American Institute of Electrical Engineers, shown in Fig. 4.

(2) By means of the regulator in the primary, adjust the testing outfit to deliver minimum voltage.

(3) Connect the apparatus to be tested to the secondary of the testing outfit.

(4) Close primary switch and gradually increase the voltage until the desired potential is indicated on the electrostatic voltmeter.

(5) Reduce the voltage slowly.

The importance of the insulation test cannot be overestimated. A transformer may have an exceedingly low core loss, excellent regulation, and low temperature rise, yet if its insulation is weak or defective the transformer fails in the one duty above all others for which it is designed. Protection to customers should be the first point considered by central station managers.

Whether the transformer possesses sufficient strength to resist the strain to which it is continuously subjected can only be determined by the application of a high potential test to the insulation. Mechanical examination amounts to little, and measurement of insulation resistance is equally valueless, for insulation may show high resistance when measured by a galvanometer with low voltage, but offer comparatively little resistance to high potential strains.

The insulation test which should be applied to the winding of a transformer depends upon the voltage for which the transformer is designed. In standard lighting transformers for 2,000 volts primary, a test of 6,000 volts is often considered ample. The General Electric Company, however, regards transformer insulation as so vitally important that standard Type H transformers—for 2,000-volt service—are, in all cases, subjected to 10,000 volts between the primary and secondary, and between the primary and the core.

From one point of view, the factor of safety of the secondary need not be greater than that of the primary, and if

10,000 volts is considered a sufficient test for a 2,000-volt primary, 1,000 volts might be sufficient for a 200-volt secondary. But a thin film of insulation may easily withstand a test of 1,000 volts, although it is so weak mechanically as to be dangerous. A 200-volt secondary should, therefore, be tested for at least 2,500 volts, in order to guarantee it against breakdown due to mechanical weakness.

The duration of the insulation test may vary somewhat with the magnitude of the voltage applied to the transformer. If the test is a severe one, it should not be longer than one minute, for while the insulation may readily withstand the momentary application of a voltage five, or even ten times, the normal strain, yet continued application of the voltage may injure the insulation and permanently reduce its strength.

Attention has been called to the fact that in testing between the primary and the core or the secondary, the secondary should be grounded. In testing between one winding and the core, for example, an induced potential strain is obtained between the core and the other winding which may be much greater than the strain to which the insulation is subjected under normal working conditions, and greater, therefore, than it is designed to withstand. In testing between the primary and the core, the induced potential between the secondary and the core may be several thousand volts, and the

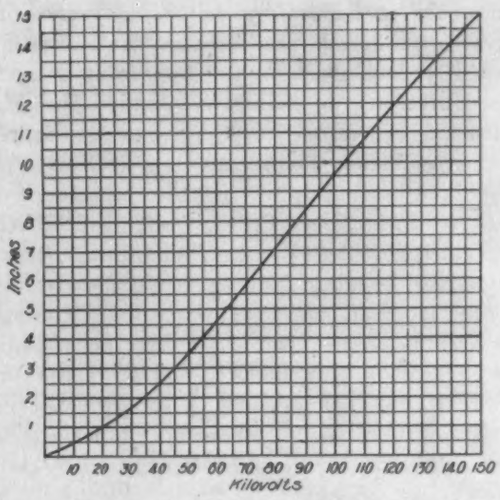


Fig. 4.—Standard Spark Gap Curve.

secondary may thus be broken down by an insulation test applied to the primary under conditions which do not exist in the natural use of the transformer.

Attention is further called to the fact that during the test, all primary leads, as well as all secondary leads, should be connected together. If only one terminal of the transformer winding is connected to the high potential transformer, the potential strain to which it is subjected may vary throughout the winding, and may even be very much greater at some point than at the terminals to which the voltage is applied. Under such conditions the reading of the static voltmeter affords no indication of the strain to which the winding is subjected.

Indications which are best learned by experience reveal to the operator the character of the insulation under test. The transformer in test requires a charging current varying in magnitude with its size and design. Fom the reading of the ammeter, placed in the low potential circuit of the testing transformer, the charging current may be ascertained. It will increase as the voltage applied to the insulation is increased.

If the insulation under test be good there will be no difficulty in bringing the potential up to the desired value, provided the transformer be of sufficient capacity. If the insulation be weak or defective, it will be impossible to obtain a high voltage across it, and an excessive charging current will be indicated by the ammeter.

Inability to obtain the desired potential across the insulation may be the result merely of large electrostatic capacity of the insulation and windings and the consequent high charging current required, so that the high-potential transformer may not be large enough to supply this current at the voltage desired.

A break-down in the insulation will result in a drop in voltage indicated by the electrostatic voltmeter, an excessive charging current, and the burning of the insulation if the discharge be continued for any length of time.

APPROVED ELECTRICAL DEVICES.

CABINETS.

Metropolitan steel or wooden cabinets for panelboards or switches, with gutters and linings of slate, marble or steel; steel or wooden doors and trim. Approved June 18, 1907. Manufactured by

Metropolitan Switchboard Co., New York, N. Y.

FIXTURES.

"Taussig" show-case and wall-case reflectors; metal troughs fitted with standard sockets for incandescent lamps; wiring in tubes or channels of No. 18 metal. Approved June 18, 1907. Manufactured by

J. Taussig, Chicago, Ill.

FUSES, PLUG.

G. E. 3-30 amperes, 125 volts, porcelain bases with brass and mica caps firmly spun into position on the base. Approved June 15, 1907. Manufactured by

General Electric Co., Schenectady, N. Y.

HEATERS, ELECTRIC.

"Simplex" Cooking and Heating Devices having heater parts consisting of wires imbedded in enamel on metal plates, grids, or tubes for 125 and 250-volt circuits. Devices include chafing dishes, tea, coffee and hot water urns, portable and ornamental cooking stoves, indispensable water heaters, travelers' stoves, standard and jacketted urns, curling iron heaters, and a dental sterilizer. Approved June 18, 1907. Manufactured by

Simplex Electric Heating Co., Cambridge, Mass.

LAMP GUARDS.

"Hubbell." Approved June 18, 1907. Manufactured by

Harvey Hubbell, Inc., Bridgeport, Conn.

PANELBOARDS.

"Metropolitan," 125 and 250 volts; all capacities and types. Approved June 18, 1907. Manufactured by

Metropolitan Switchboard Co., New York.

RECEPTACLES, STANDARD.

Connecticut. A porcelain receptacle for signs or conduit outlet boxes, 3 amperes, 250 volts, with or without cover. Approved June 18, 1907. Manufactured by

The Connecticut Electric Mfg. Co., Bantam, Conn.

RECEPTACLES, STANDARD.

G. M. & S. Co. Waterproof receptacle. Catalogue No. 9500. Approved June 18, 1907. Manufactured by

The General Mfg. & Supply Co., Trenton, N. J.

RHEOSTATS.

Ward Leonard. FM, FME, SM, SME, EM, EME types motor field rheostats, 125 and 250 volts, FFE and FBE types generator field rheostats with no voltage release, 50-600 volts. Approved June 18, 1907. Manufactured by

The Ward Leonard Electric Co., Bronxville, N. Y.

ROSETTES, FUSELESS.

Knowles cleat types, Nos. 2500 and 1601, 3 amperes, 250 volts. Approved June 18, 1907. Manufactured by

C. S. Knowles, Boston, Mass.

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EDITORIAL.

"THE MINER'S INCH."

In connection with the building of hydro-electric power transmission systems, there is certainly nothing more important than to definitely establish the total amount of water available during the different seasons of each year. The best method of measuring water depends in many cases upon the quantity of flow. In California particularly, the so-called "miner's inch" is extensively employed as the unit of the flow of water. Its great convenience is, however, seriously impaired, as the quantity of water represented by a "miner's inch" varies in different parts of the State.

The term was used originally in the northern mining districts where hydraulic mining was practiced. Water was purchased from the ditch companies which controlled the available supply of water, and a convenient method of measuring the water supplied to the mines was a necessity. The method of measurement to be of value must, necessarily, be easily understood by the ordinary miner, and one which would give, without complex calculations, the exact flow of water. The method selected, named and defined, was as follows:

That quantity of water which shall flow through an opening one inch square, made in a plank one and one-quarter inches thick, and under a head of five inches, measured from the center of the hole, shall be called a "miner's inch." This unit of measurement, therefore, became a part of many contracts between the water companies and the miners in the State.

This very simple and convenient method of measurement has long since been adopted in other places. The amount of water represented by a "miner's inch," however, has been changed inasmuch as the head under which the flow occurs has been varied from four to seven inches; again, the orifice might be made in a board of any thickness, as originally defined, provided the area of the opening was exact. On the other hand, the orifice might be made in a thin sheet of metal, in which case the crest would be small. Each condition naturally changed the actual flow through the orifice.

Legally the "miner's inch" has been fixed by an act of the Legislature of the State. This act defines a "miner's inch" to be 1½ cubic feet per minute, flowing through an orifice of any area under any head whatsoever.

In order to accurately calibrate orifices of different areas under different heads, an investigation has recently been made in the hydraulic laboratories of the University of California, under the general direction of Professor J. N. Le Conte, the results of the experiments being of great value to those interested in any manner in the measurement of water. As water flows through any orifice, because of its velocity, it tends not to shoot out perpendicularly to the opening, but to curve inward toward the center from all sides. This causes a contraction of the area near the orifice, so that the actual area of the stream is less than the area of the orifice. Also due to the friction of the sides of the orifice and the fact that the water is not a perfect liquid, the actual velocity of the flow is somewhat less than the theoretical velocity.

Naturally, the real quantity of water flowing through the orifice will be found by multiplying the area of the orifice by the velocity of the water. The contraction of the area, as well as the reduction of the velocity, due to friction, etc., introduces a constant which shows the relation between the quantity of water and the velocity, which constant is ordinarily known as "C."

It was for the purpose of determining the value of this constant "C," to determine the actual flow under various conditions, and to determine the relation of each to a well-defined standard, that the experimental investigation was undertaken, as above indicated.

The constant "C" depends upon the size and shape of the orifice itself, the size and shape of the crest of the orifice, the head under which the flow takes place, and also depends upon the velocity of approach toward the orifice. In all accurate measurements of water by the means of weirs, the velocity of approach is made as small as possible. In the experiments made, particular care was taken to

render this velocity negligible, and it has, therefore, been omitted in the determinations of the constant "C." In general, the experiments were made in the following manner:

A large weir box was constructed, the outlet consisting of a plank covered on the inside with a metal sheet which was cut in the proper form for the weir. A centrifugal pump, driven by electric motor, furnished the water required, which was delivered to a regulating tank provided with two separate outlets, one into the weir box and the other a spillway out of which the waste water was allowed to flow back to the pump inlet, and used in this way a second time.

In all the results covered, the determination of the constant "C" where the area of the orifice in square feet varied from .07 to .496 of a square foot, or, put in another way, the area of the orifice was made to vary from 1 to 72 square inches, the quantity of water passing through the various sized orifices was made to vary from 1.246 cubic feet per minute up to 106.01 cubic feet per minute. The various sized orifices were tested under heads varying from 4 inches to 6 inches and the actual openings were 1 inch, 2 inches, and 4 inches in height.

The constant "C" was found not to be actually constant, but varied between the extreme limits of .597 as a minimum to .679 as a maximum. "C" was found to be, in general, largest when the opening was the smallest.

The result of such experiments as these is that the engineer is able to build the most accurate and satisfactory weirs for the measurement of water. The care with which the experiments were made, and their absolute reliability, gives the results an especial value. The work is to be continued as soon as possible into a broader field and the additional results will surely be welcomed by hydraulic engineers.

AN UNCLEAN FARCE.

It is no hazard to say that nine men out of ten rubbed their eyes with astonishment last Wednesday morning when they saw the announcement that the chief magistracy of this city had been delivered once more into the hands of yet another self-confessed grafter. It is true that the prosecution accompanied their selection of Dr. Charles Boxton with an elaborate apology, admitting that "the situation is unfortunate," but "the selection of Boxton is but a means to an end," and "necessary to avoid legal embarrassment." "The selection of Boxton is only a necessary step to accomplish the end we have in view of establishing a clean government." Mr. Langdon has sent out cards of invitation to various bodies asking that the names of the delegates to the prosecution's proposed convention be delivered to his office on or before July 13, and proposes that the Mayor be nominated within five days thereafter.

The prosecution, which is trying every device to maintain its popularity, embarked on the fatuous and hopeless course of selecting a man for the Mayoralty who would "please everybody." The prosecution had promised us a Mayor of whom San Francisco need not hold her head in shame, not later than June 27. Public patience is well-nigh exhausted. There is little to choose between Schmitz, Gallagher and Boxton, unless it be by comparison of their abilities as grafters. Gallagher's selection was endurable only as a temporary inconvenience and disgrace; but the appointment of Charles Boxton, perhaps the most shameless and cheapest of the bribe-taking Supervisors, is an intolerable climax to an unclean farce.

If anything had been needed to show the folly of the people relinquishing their rights and privileges to the custody of a single dictator or triumvirate, and submitting with so much long suffering to the vagaries of the "Big Stick," surely the Mayoralty of Charles Boxton supplies it.

The pretense on the part of the prosecution that it was necessary to select for the Mayoralty one of the Board of Supervisors, is palpably indefensible. Indeed, before Boxton was leveled to the Mayoralty he was required to resign from the Board of Supervisors. Boxton's selection, in the face of the fact that there are 75,000 citizens of San Francisco from whom to select a Mayor, cannot be explained, except on the theory that the prosecution preferred one of its "good dogs" whom it could whip into subservience.

In reference to Mr. Langdon's proposed convention of thirty, to whom he has delegated the function of choosing Boxton's successor, it is proper to point out the ineligibility of half that proposed body.

There is at present in San Francisco an illegal boycott in restraint of trade. Such offense is indictable by the Grand Jury and its statutory punishment is imprisonment in the penitentiary. Every man engaged in such illegal conspiracy is guilty of a felony. Such conspiracy is being carried out by a committee composed of ten members appointed by the Council of Labor, ten members appointed by the Building Trades Council, and five by the Carmen's Union It has been organized as a campaign strike committee, and its main object is to interfere unlawfully with the business of the United Railroads, to obstruct the operation of their cars and to molest their passengers by the instruments of the picket and the boycott.

It is to be noted that half of the members of the Mayoralty convention are to be appointed by these law-breakers, and at the instance of the District Attorney's office, the officials of which are sworn to prosecute impartially all offenders against the law.

This body of men now engaged in illegal boycott and restraint of trade is profoundly interested in the control of the Police Department. There is nothing that lawless unionism fears so much as the police. Preserve the law and it is impossible for any body of men to destroy industrial freedom and individual liberty.

But we witness the amazing spectacle of the law officers of this county, the graft prosecutors, giving to the lawless union element represented by the Council of Labor eight votes in the proposed convention, while they give to the Merchants' Association only three, and giving the Building Trades Council seven, while they give to the Board of Trade but three. It might be suggested that the proper chairman of a convention so constituted would be Richard Cornelius, and its proper choice for Mayor, Andrew Furuseth.

With Furuseth in the Mayor's chair and Dick Cornelius as Chief of Police, the laws of this community would be strictly enforced in favor of industrial freedom—freedom with a club.

By such tactics San Francisco is made the laughing stock of our own citizens and a target of reproach throughout the world. Our municipal government has been a farce for many months and an unclean farce. Long ago the curtain should have been rung down on such a travesty on government.

The prosecution is profuse in its apologies that it is not playing politics. But it is obvious that Mr. Spreckels and his colleagues, while professing to keep their skirts immaculate from political ambitions and private designs, have fallen by the wayside. If they had had the courage of their convictions they would have followed out their first program. They would have told Supervisor Lonergan or another of their "good dogs" to lie down and resign his office. In his stead on the Board of Supervisors they would have placed a man, not one who would "please everybody," but one of whose integrity of purpose and executive ability they themselves were satisfied. Then within twenty-four hours such a man could have occupied the Mayor's chair, and this unclean farce would have been terminated.

The prosecution can not shirk the responsibility of the position which it sought itself. The prosecution aimed at the control of the city government. It has had it for several months. Instead of cleaning out the supervisorial kennel of its "good dogs," and substituting in their place citizens who at least could be trusted by the prosecution to give the city an honest, able and dignified administration, they have perpetuated the farce of keeping the "good dogs" at work and heading the pack with a Boxton.

We must confess that we have no confidence in the proposed convention which Mr. Langdon has called to meet about July 18. Half the proposed body is to consist of fifteen members of the two principal Labor Union organizations, the Building Trades Council and the Council of Labor. The other half is to consist of representatives of the Merchants' Association, the Chamber of Commerce, the Board of Trade, the Real Estate Board and the Merchants' Exchange. Is it likely that a body so constituted will agree even by August 1st upon a satisfactory head of the municipal government?

We consider that the prosecution has shirked its duty and must be held responsible for the unclean farce which is still in progress.

PERSONAL.

Eugene de Sabla has opened offices in the French Bank Building, San Francisco.

John Martin has opened up an office in the Merchants' Exchange Building, San Francisco.

C. E. Hardy is now master electrician, department of construction and repair, navy yard, Mare Island, Cal.

B. W. Mendenhall is manager of the Ely Light & Power Company at Ely, White Pine County, Nevada.

J. W. White was recently appointed superintendent of the Nevada-California Power Company at Goldfield, Nevada.

J. C. Kirkpatrick, representing the National Pole Company, left Saturday night for a business trip which will take in Everett, Washington, and other towns on the Coast.

John A. Britton has resigned as president and C. W. Conlisk as secretary of the Pacific Gas & Electric Company. Frank G. Drum has succeeded Mr. Britton, who has been elected vice-president of the Pacific Gas & Electric Company and president of the California Gas & Electric Corportation. Eugene de Sabla, Jr., resigned the latter place in favor of Britton. The latter retains the presidency of the San Francisco Gas & Electric Company and is in addition general manager of all three companies.

TRADE CATALOGUES.

Catalogue No. 19 of the Chicago Fuse Wire & Manufacturing Company, of Chicago, Ill., is a well-illustrated price list of fuse-protecting material for every kind of electrical service.

Bulletin No. 1094, from the Fort Wayne Electric Works, Fort Wayne, Ind., shows the excellent construction of their Type LF, belted, direct-current generators. Bulletin No. 1095 displays their enclosed A. C. multiple arc lamps. No. 1096 illustrates and describes Type A constant potential transformers for line service. It might be added that the phraseology in these bulletins is of as high a standard as any that we receive and adds much to a ready comprehension of the principles set forth.

PUBLICATIONS RECEIVED.

The appearance of a second edition of "A Method for Calculating Steam Power Plant Economy," by C. R. Weymouth, is indicative of the favorable reception given this excellent treatise by the engineering fraternity. In it steam- and electrically-driven auxiliaries are compared as to initial cost of plant, costs of operation and fuel costs with reference to Pacific Coast conditions, special reference being made to the use of fuel oil. The tables and calculations contain a great amount of valuable information condensed into small space. The purpose of the article is well expressed in the author's introduction: "Exact calculation of the economy of any given power plant, for an assumed set of conditions, is almost an impossibility, * * * but there are occasions when it is necessary to estimate such economies, either for the purpose of making guarantees on prospective plants or to determine how closely any existing plant approaches its maximum possible economy." The treatise has been handsomely printed for gratuitous distribution by Chas. C. Moore & Co., engineers, San Francisco, Cal. It has has been revised since its first appearance in the columns of the Journal of Electricity, Power and Gas.

LOCAL STOCKS AND BONDS

Furnished by Courtesy San Francisco Stock and Bond Exchange.

Outstanding	INTEREST	MISCELLANEOUS BONDS.	JULY 1		JULY 8		JULY 9		JULY 10		JULY 11			
			Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked	Bid	Asked
1,532,000	F & A	Associated Oil Co. 5%	79	81	78	81	79	82	79	81	79	.....	.....	.....
2,250,000	M & S	Bay Counties Power Co. 5%	.....	99	.....	99	.....	99	.....	99	.....	99	.....	.....
1,000,000	F & A	Cal. Central Gas & El. 5%	.....	103	.....	103	.....	103	.....	103	.....	103	.....	.....
9,600,000	M & S	Cal. Gas & El. Gen. M. & C. T. 5%	.....	80	.....	80	77½	80	77½	.....	77½	80	.....	.....
900,000	J & J	California St. Cable Co. 5%	98	101	98	101	98	101	98	101	98	101	.....	.....
2,000,000	J & J	Contra Costa Water Co. 5%	99	.....	99	.....	99	.....	99	.....	100	102	.....	.....
1,000,000	J & J	do do Gen. Mtg. 5%	.....	98	.....	98	.....	97	.....	97	.....	97	.....	.....
623,000	P M A N	Edison Light & Power 6%	.....	115	.....	115	.....	115	.....	115	.....	115	.....	.....
650,000	M & S	Ferries & Cliff Ho. Ry. 6%	103	.....	103½	.....	103	.....	103	.....	103	.....	.....	.....
671,000	A & O	Geary St. Ry. 5%	52	.....	52	.....	52	.....	52	.....	52	.....	.....	.....
610,000	M & N	Honolulu R. T. & L. Co. 6%	105¼	.....	105¼	.....	105½	.....	105½	.....	105½	.....	.....	.....
300,000	A & O	Lake Tahoe Ry. & T. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
500,000	J & J	Los Angeles Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	.....
1,300,000	J & J	Los Angeles Gas & Elec. Co. 5%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5,000,000	A & O	Los Angeles Ry. 5%	106½	107	107	.....	107	.....	107	.....	108	.....	.....	.....
1,000,000	A & O	Los Angeles Lighting Gd. 5%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	.....
1,500,000	A & O	Los Angeles Pac. R. R., 1st Con. Mtg. 5%	102	103½	102	103½	.....	.....	102¾	103¼	.....	103½	.....	.....
3,030,000	M & S	L. A. Pac. R. R. of Cal. 5%	.....	102½	.....	102½	.....	101	.....	102¾	.....	101½	.....	.....
3,000,000	J & J	Market Street Cab'e 6%	106	.....	108	.....	108	.....	108	.....	108	.....	.....	.....
5,141,000	M & S	do Ry., 1st Cons. Mtg. 5%	100	101½	101	101½	101½	.....	101½	.....	101½	.....	.....	.....
100,000	A & O	Mill Valley & Mt. Tamalpais S.Ry. 5%	103	.....	103	.....	103	.....	103	.....	103	.....	.....	.....
4,751,000	A & O	Northern Ry. Co. of (Cal.) 5%	110½	.....	113½	.....	111	.....	112	.....	112	113	.....	.....
1,498,000	J & J	North Pacific Coast R. R. 5%	98	.....	98	.....	98	.....	99½	.....	99½	.....	.....	.....
1,074,000	J & D	Northern Cal. Railway 5%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	.....
980,000	J & D	Northern Cal. Power Co. 5%	.....	99	.....	98	97½	99	97½	99	97½	99	.....	.....
6,000,000	A & O	Northern Electric Co. 5%	.....	97½	.....	97½	.....	97½	.....	97½	.....	97½	.....	.....
1,000,000	M & S	Oakland Gas Light and H. 5%	.....	105	102	107	102	107	.....	106	102	106	.....	.....
1,374,000	J & J	Oakland Transit Co. 6%	111¼	.....	108	.....	108½	.....	108½	.....	109	.....	.....	.....
1,600,000	J & J	Oakland Transit 5%	100	.....	100	.....	101¼	.....	100	.....	101½	.....	.....	.....
1,326,000	J & J	Oakland Transit Con. 5%	.....	102	.....	102	.....	102	99¾	.....	100	.....	.....	.....
7,000,000	J & J	Oakland Traction Con. 5%	.....	99	.....	.....	.....	99	.....	99	.....	99	.....	.....
1,500,000	J & J	Oakland Water Co. gtd. 5%	92	99	92	99	.....	97½	.....	97½	.....	97½	.....	.....
2,000,000	A & O	Omnibus Cable Ry. 6%	110	115	110	115	.....	113½	.....	114	.....	114	.....	.....
1,149,000	S D M J	Pacific Gas Imp. 4%	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....	.....
8,494,000	J & J	Pacific Electric Ry. Co. 5%	100	.....	100	102½	101	102½	100¾	.....	101	.....	.....	.....
4,491,000	J & J	Pacific Light & Power Co. 5%	.....	100¼	.....	100¼	.....	100¼	.....	100¼	.....	100¼	.....	.....
3,000,000	J & J	Pacific Tel. & Tel. Co. 5%	.....	104	.....	.....	.....	.....	.....	.....	.....	103	.....	.....
350,000	J & J	Park & Cliff House Ry. 6%	101	102½	101	102½	101	102½	101	102½	101	102½	.....	.....
250,000	J & J	Park & Ocean R. R. 6%	102	.....	102	.....	102	.....	102	.....	102	.....	.....	.....
700,000	M & S	Powell Street Railway 6%	.....	107½	.....	107½	.....	107½	.....	107½	.....	107½	.....	.....
2,500,000	M & N	Sacramento Elec. Gas & Ry. 5%	.....	100	97¼	.....	.....	98	97	.....	97	.....	.....	.....
6,000,000	A & O	S. F. & S. J. Valley Ry. 5%	111½	.....	112	.....	112	115	112½	.....	112½	113½	.....	.....
3,000,000	J & J	S. F., Oak. & San Jose Ry. 5%	.....	105	.....	104½	101	104	101	105	101¾	103	.....	.....
1,500,000	J & J	do do 2d Mtg. 5%	.....	101	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1,500,000	A & O	S. J. & S. Clara Co. R. R. 4½%	.....	91	.....	91	.....	91	.....	91	.....	95	.....	.....
642,000	A & O	Sierra Ry. of Cal. 6%	.....	105	.....	105	.....	109	.....	109	.....	109	.....	.....
6,000,000	J & J	S. P. R. R. of Arizona 6% (1909)	101	.....	100	101	100	101¼	100¾	101	100½	101	.....	.....
4,000,000	J & J	do do do (1910)	102	.....	101½	102½	.....	102¼	101¼	101¾	101½	.....	.....	.....
5,116,000	A & O	S. P. R. R. of Cal. 6% (1912)	.....	110	.....	110	.....	110	.....	110	.....	110	.....	.....
4,127,500	M & N	S. P. R. R. of. Cal., 1st c. gtd. 5%	113⅜	116⅞	113⅜	116⅞	113⅜	116⅞	113⅜	116⅞	114	117	.....	.....
3,533,000	A & O	S. P. Branch Ry. of Cal., 6%	124½	.....	124½	.....	125	.....	125	.....	125	.....	.....	.....
81,178,000	J & J	S. P. R. R. Co., 1st Ref'd'g. 4%	90	.....	90¾	91½	91	91½	91	91½	91	.....	.....	.....
17,500,000	J & D	Spring Valley Water Co. Gen. Mtg. 4%	84¼	.....	84¼	.....	84¼	.....	84¼	.....	84¼	.....	.....	.....
300,000	M & S	Stockton Gas & Elec. Co. 6%	100	.....	100	.....	100	.....	100	.....	100	.....	.....	.....
2,000,000	J & J	United Gas & Elec. Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	.....
20,000,000	A & O	United R. R. of S. F. 4%	70¾	72	71½	72	71⅞	.....	71¾	72½	.....	72¼	.....	.....
2,500,000	M & N	Valleys Counties Power Co. 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	.....
		Water Stocks.												
.....	.....	Contra Costa	.....	62	.....	62	.....	62	.....	62	.....	62	.....	.....
6,000	Quarterly	Marin County	.....	62	.....	62	.....	62	.....	62	.....	62	.....	.....
280,000	.....	Spring Valley Water Co.	20	.....	20¾	21½	20¾	21½	20¾	21½	20¼	20¾	.....	.....
		Gas and Electric Stocks.												
37,500	.....	Martel Power Co.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9,340	.....	Mutual Electric Light Co. (Ctfs.)	4½	.....	4½	.....	4½	.....	4½	.....	4½	.....	.....	.....
37,336	.....	do (Extended Ctfs.)	12⅛	.....	12⅛	.....	12⅛	.....	12⅛	.....	12⅛	.....	.....	.....
40,000	Monthly	Pacific Lighting Co.	.....	70	.....	70	60	70	60	70	60	70	.....	.....
12,000	.....	Stockton Gas & Elec. Co.	52	.....	52	.....	52	.....	52	.....	52	.....	.....	.....
		Street Railroad Stocks.												
10,000	.....	California	.....	135	.....	135	.....	140	.....	140	.....	140	.....	.....
10,000	.....	Geary	.....	41	.....	41	.....	41	.....	41	.....	41	.....	.....
10,000	.....	Presidio	.....	25	.....	25	.....	25	.....	25	.....	25	.....	.....
	Semi-an.	Associated Oil Co.	29¾	.....	29¾	30¼	30	31	29¼	30¼	28	30	.....	.....
1,625	Quarterly	Mill Valley & Mt. Tamalpais S. Ry.	.....	110	.....	110	.....	110	.....	110	.....	110	.....	.....
180,000	Quarterly	Pac. Tel. & Tel. Co. (Pfd.)	.....	100	.....	100	.....	100	.....	100	.....	95	.....	.....
180,000	.....	Pac. Tel. & Tel. Co. (Common)	7½	15	7½	15	7½	15	7½	15	.....	15	.....	.....

Unlisted Securities

750,000	A & O	Bay Counties Power Co. 6%	.....	103	.....	103½	.....	103½	.....	103½	.....	103½	.....	.....
745,000	M & S	Blue Lakes Water Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,000,000	A & O	California Northwestern Ry. 5%	.....	108	.....	108	.....	108	.....	108	.....	108	.....	.....
160,000	J A J O	Marin County Water 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	.....
600,000	J & J	Risdon Iron Works 5%	.....	100	.....	100	.....	100	.....	100	.....	100	.....	.....
500,000	M & S	S. F. Dry Dock 5%	.....	109	.....	109	.....	109	.....	109	.....	109	.....	.....
8,000,000	M & N	S. F. Gas & Electric 4½%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	.....
3,926,000	J & J	S. F. & North Pacific Ry. 5%	103	.....	101	.....	102	.....	100	105	100	105	.....	.....
5,500,000	J & J	South Pacific Coast Ry. 4%	.....	95	.....	95	.....	95	.....	95	.....	95	.....	.....
.....	.....	Standard Electric Co. 5%	.....	92½	.....	92½	.....	92½	.....	92½	.....	92½	.....	.....
.....	.....	do do Gtd. 5%	80	86	80	86	80	86	80	86	80	86	.....	.....
750,000	J & J	Sunset Tel. & Tel. Co. 6%	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2,250,000	A & O	Sunset Tel. & Tel. Co. 5%	.....	105¼	.....	105¼	.....	105¼	.....	105¼	.....	105¼	.....	.....
1,000,000	M & N	Sutter Street Railway 5%	.....	105	.....	105	.....	105	.....	105	.....	105	.....	.....
		Stocks.												
50,000	Monthly	Gas Consumers' Association	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
100,000	Monthly	Northern Cal. Power Co.	21	.....	21½	.....	22	.....	23¼	25	24¾	26	.....	.....
.....	.....	Pac. Gas & Elec. (Pfd.)	.....	50	.....	50	.....	50	.....	50	.....	50	.....	.....
.....	.....	Santa Cruz Port. Cement	.....	55	.....	50	.....	50	.....	50	.....	50	.....	.....
.....	.....	Standard Port. Cement (New)	.....	63	.....	55	.....	55	.....	55	.....	55	.....	.....
50,000	Monthly	Truckee Electric Co.	.....	15	14½	.....	14½	.....	14½	.....	14½	.....	.....	.....

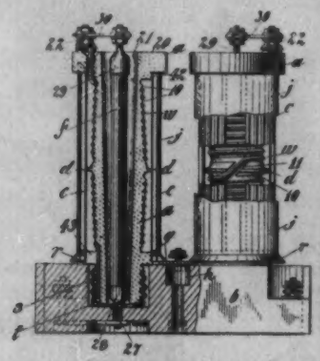
PATENTS

Electric, Gas and Water.

Specially reported for the Journal of Electricity, Power and Gas.

LIGHTNING ARRESTER. 857,045. George L. Foote, New York, N. Y., assignor to Foote, Pierson & Company, New York, N. Y.

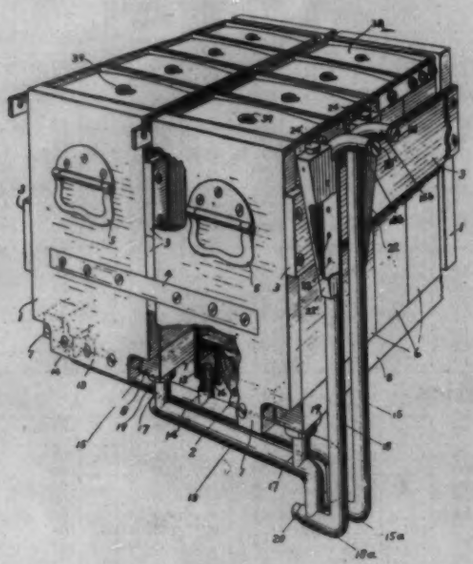
In a lightning arrester the combination of a tapered core of insulating material having a helical groove in its



surface, a bare conductor supported in groove and an insulated conducting medium fixed parallel with the axis of core and near to conductor.

ELECTRO-CHEMICAL APPARATUS. 857,607. Frank A. Decker, Philadelphia, Pa., assignor to Decker Electrical Manufacturing Company, Wilmington, Del.

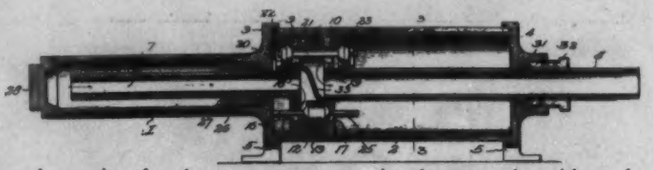
A plurality of crates arranged in parallel with corresponding ends connected together, each crate having bottom strips of less width than the ends and side strips disposed



at different elevations permitting juxtaposed side strips of joined crates to lie one above the other, in combination with a series of cells in each of crates, and conduits secured to the bottoms of the envelopes of the cells and disposed on either side of the bottom strips thereof, the conduits communicating with the interiors of the respective cells.

WATER-MOTOR. 858,226. Joseph P. Shevlin and Henry P. Shevlin, Denver, Colo.

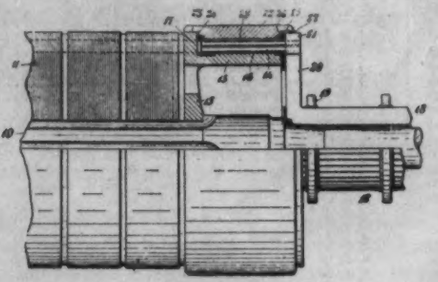
In a water-motor, a valve cylinder, having cylinder heads at its opposite ends, a hollow piston rod in cylinder, a hollow piston connected to piston rod, an automatic water-controlled inlet valve in piston head arranged to discharge water into the opposite ends of cylinder, a reciprocating sleeve surrounding valve, pins on the opposite ends of sleeve adapted to engage the opposite cylinder heads of cylinder,



and a pair of exhaust water ports in the opposite sides of hollow piston, having valve seats in their outer ends, valves mounted on the opposite ends of a single valve stem arranged to extend through piston head, said valves being arranged on the opposite sides of piston head and adapted to control valve seats, and sleeves surrounding valves adapted to be moved by engagement with cylinder heads to control valve ports and arranged to exhaust the water from the opposite ends of cylinder.

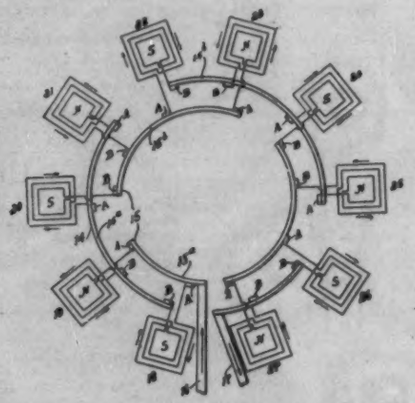
DIRECT-CURRENT DYNAMO-ELECTRIC MACHINE. 858,246. Edwin C. Wright, Newport, Ky., assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company.

In combination, an armature, a core, coils carried by core and projecting beyond the end thereof, a ring surround-



ing the projecting portions of the coils, a commutator, and commutator leads or necks connecting the coils and commutator bars, leads or necks serving to retain the ring in position.

DYNAMO-ELECTRIC MACHINE. 858,097. Bradley T. McCormick, Cincinnati, Ohio, assignor to the Bullock Electric Manufacturing Company.



In a dynamo-electric machine, field poles having series windings, the coils of the series winding being connected in multiple-series and connectors for the coils, all the connectors being on the same side of the machine.

INDUSTRIAL

COMMUTATING POLE RAILWAY MOTORS.

The gradual increase of operating voltages on direct-current electric railroads, especially on large systems or interurban roads, has introduced new requirements in railway motor design largely relating to the commutation and non-flashing properties of the motor. The commutating pole

GE-205 RAILWAY MOTOR, BACK

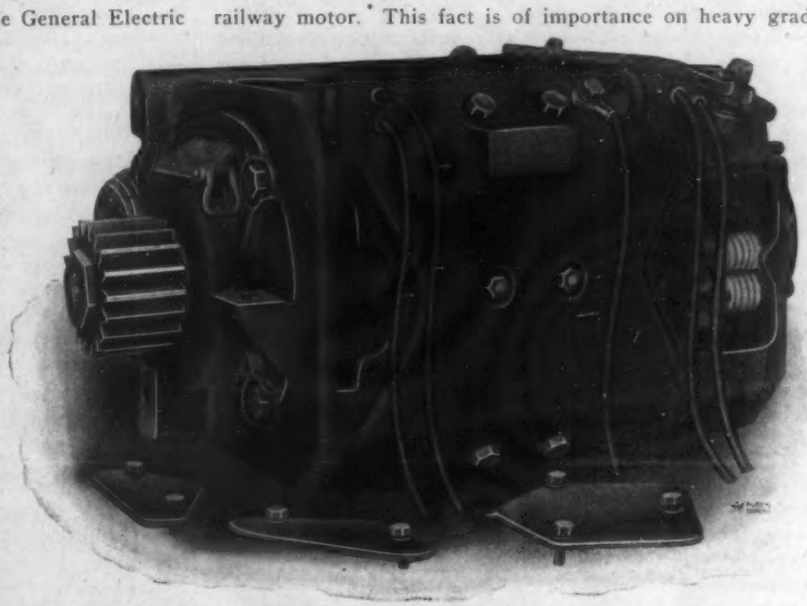
type of railway motor is specially well adapted to meet the conditions due to this development, and the General Electric Company has therefore designed and manufactured a line of these motors which embody all the requisites for this class of service.

At the present time six different motors are manufactured varying in output from 50 horsepower to 200 horsepower. These motors are called GE-202, GE-204, GE-205, GE-206, GE-207, and GE-208, arranged in order of size. As occasion demands other motors will be constructed in sizes to meet railway service conditions.

The two smallest motors, namely, GE-202, and GE-204, are constructed with a split frame designed to allow the bottom part to be swung down into a pit for inspection or renewal of parts. The largest motors are of the box frame type with large bored openings at each end through which the armature can be readily inserted or removed. The general construction of both types is similar to that employed in the General Electric Company's well-known railway motors, the chief point of difference lying in the addition of commutating poles.

The theory and functions of commutating poles have long been understood, but it will not be out of place here to give a brief summary of their action and the advantages obtained by their use. The commutating poles, located between the main exciting pole pieces, are connected up with their windings in series with one another and with the armature. The magnetic strength of the commutating pole varies therefore with the current through the armature, and a magnetic field is produced of such intensity as to properly reverse the current in the armature coils short-circuited during commutation. The pole pieces are so proportioned and wound as to compensate for armature reaction and practically non-flashing and sparkless commutation is insured up to the severest overloads. As the magnetizing current around the commutating poles is reversed with the armature, the poles perform their functions equally well in whichever direction the motors are running.

Due to the remarkably good commutating characteristics of commutating pole railway motors, their overload capacities are considerably increased and a more rugged form of motor is obtained which is less subject to injury through careless handling by motormen than the present standard railway motor. This fact is of importance on heavy grades



GE-205 RAILWAY MOTOR, FRONT

or where cars are provided with equipments geared for high speed work, and at the same time are required to stop and start frequently in cities. If for electric locomotives or other special applications, forced ventilation is used, high

continuous outputs can be obtained from these motors as the current input can be considerably increased without commutation difficulties occurring, the heating of the motor being kept within normal limits by the increased ventilation, which may be effected by means of a blower.

GE-204 RAILWAY MOTOR, WITH FRAME LOWERED FOR INSPECTION

TEST OF INDUCTION MOTORS AT FACTORY OF WADSWORTH-HOWLAND COMPANY, CHICAGO.

Some months ago the Wadsworth-Howland Company of Chicago, large paint manufacturers, suffered the loss of their plant through fire, and instead of rebuilding upon the old site, purchased the paint works of Geo. W. Pitkin & Company, then in process of building and equipment with Allis-Chalmers induction motors for driving the entire plant.

The electric motor equipment comprises forty-odd Allis-Chalmers induction motors, ranging from one to thirty horsepower and aggregating over 300 horsepower. Four 30-horsepower motors, operating at a speed of 900 revolutions per minute, drive six lead mixers; five 10-horsepower motors at 1200 revolutions per minute, drive the white lead and putty chasers, three of the number being used on tandem mills. Fourteen 5-horsepower machines are used on No. 6 "A" sampling mills, and others for driving 20-inch water-cooled mills. Nine 3-horsepower motors at 1800 revolutions per minute drive water-cooled mills; two 1-horsepower motors drive seamers, individual tanks and other auxiliary apparatus throughout the plant. All motors are belted to paint machinery built by Kaestner & Company, of Chicago, which in most cases runs at slow speed, for which reason it is necessary to belt to each machine or group of machines through a countershaft in order to reduce the speed.

A test which was recently made on one of the paint grinders to determine exactly the power consumed in its operation resulted as given in the following report. These results are interesting as compared with other methods of applying motors for this work, and from the description of the process of grinding paint.

The mill on which the tests were made is used for grinding yellow ochre after it has passed through a mixer. The machine consists of two pairs of mill stones, about thirty inches diameter each, mounted with axes vertical. The lower stones of each pair revolve while the upper stones are fixed. One pair of stones is located in front of and below the other, so that the paint discharged from the upper pair will drop into the hopper of the lower. The fixed stones are fastened to the frame of the mill, while the lower revolving stones are carried on the ends of vertical shafts connected together by spur gearing and driven from the main shaft by a bevel gear and pinion. The main shaft runs at a speed of approximately 132-136 revolutions per minute, and with the present belted outfit is provided with tight and loose belt pulleys. The mill is driven from a small counter-shaft located directly above the main shaft, the motor being suspended from the ceiling and located about ten feet from the countershaft.

Paint mixed with linseed oil is fed from a mixer into the upper pair of stones, and after passing through them is discharged with the lower pair. The process is continuous and when the mill is first started it requires considerably more power than after an hour or so of running, when the stones have become heated and the paint more easy flowing. The power also depends on the rate of feed and the setting of the stones; if the stones are too tightly adjusted the power required is very much increased.

Test on Belted Motor.

Each of these grinders is provided with an individual 10-horsepower belted motor running at approximately 1130 revolutions per minute at full load and equipped with a standard Allis-Chalmers potential starter. The following tests were made:

1. Motor running idle with belt off.
2. Motor running belting and countershaft; mill belt on loose pulley.
3. Motor running mill and grinding paint.

In tests 1 and 2 readings of volts, amperes and watts were taken, Weston instruments being used for measuring volts and watts. Current was measured by a Thomson ammeter, which had a range of only fifteen amperes and hence was not aavilable for load readings. In test 3 indicating wattmeter readings were taken at the beginning and end of the test, and in addition a Fort Wayne polyphase recording watt-hour meter was placed in circuit to record the total watt-hours during the run. A four-hour run was made, the mill being cold when started.

Allis-Chalmers motor No. 28,869, 10 horsepower, 220 volts, 26 amperes, 3-phase, 60-cycle, 1130 revolutions per minute.

1. Motor running idle (belt off): Volts, 224-228; current, 6.5-7 amperes; total watts, 600.
2. Motor running belting and countershaft (mill belt and loose pulley): Volts, 223-225; current, 7 amperes; total watts, 900.

This shows that power required for belting and countershaft 300 watts or .4 horsepower.

hence was not available for load readings. In test 3 indiconditions: Speed of main shaft on mill, 136 revolutions per minute; volts throughout test, 220-226; total watts at beginning of run (paint stiff), 10,300; total watts at end of four-hour run, 7200.

This indicates the decreasing power consumption as the mill becomes warmed up. Total number of kilowatt hours during four-hour run as shown by recording meter, 20. This gives an average of 6½ kilowatts input required to operate the mill. In all these tests the average watts, as shown by the indicating meter, were higher than the average from the recording meter. The recording meter, a 25-ampere instrument, was overloaded part of the time and doubtless read low. The indicating meter was a new instrument carefully checked before the tests and found to be correct within one per cent.

The paint was weighed during the greater part of the run and it was found that 86.75 pounds were ground with an expenditure of 24 kilowatt-hours. With mill stones in first-class condition this output could be considerably increased without materially affecting the power consumption. In the present test the stones had not been dressed for some time previous and the amount of paint ground was therefore lower than it would otherwise have been.

The ratio of the wattmeter readings on the two sides of the circuit showed that the motor operated at an average power factor of approximately ninety per cent.

NEWS NOTES

WATERWORKS.

Reno, Nev.—The officials of the Reno Power, Light & Water Company state that the work of bringing the Hunter Creek water into this region will be continued as rapidly as possible in spite of the statement of Mayor Kirman that he will ask the City Council to bring suit against the company to prevent it from bringing Hunter Creek water into this city without a franchise.

Beatty, Nev.—A company to be known as the Beatty Land, Water & Improvement Company is being incorporated here by Los Angeles and Nevada capitalists to build a large pipe line leading from the Amargosa Valley into Beatty to operate mills, supply the city with water and provide for a large park near here. This company, which has a large supply of water, will fit up the park with a large bathing pool and with other attractions.

Oakland, Cal.—On July 9th Judge Ellsworth of this city issued a restraining order against the Owens River Water & Power Company, F. J. Early, J. H. MacDonald, E. P. Cook, E. T. Holland and T. B. Dozier, its directors, prohibiting them from selling at a delinquent assessment sale stock of the company owned by C. E. Watson, W. C. Watson, James N. Block, John Landers, Maud Dozier, W. D. Watson and Charles Wonacott. The sale had been advertised to take place on the same day that the restraining order was secured. The Owens River Water & Power Company owns rights on Owens River which are supposed to be more or less in conflict with the plans of the city of Los Angeles in the matter of the proposed Owens River water system for that city. The company was originally formed by C. E. Watson, W. C. Watson and W. D. Watson, who located the rights now held by the company. Later Edson F. Adams, of Oakland, got possession of a majority of the stock and the Watsons now accuse him of trying to freeze them out of the company.

Los Angeles, Cal.—Contracts have been awarded by the Board of Public Works for a portion of the machinery to be used in the making of cement for the Owens River aqueduct. The Pacific Coast Manufacturing Company is to furnish the following: Two water tube boilers having 5000 square feet of heating surface, each for $12,625; two water tube boilers with a heating capacity of 2500 square feet, each for $6592; nine 75-horsepower motors for $3030.30; seven 35-horsepower motors for $2702.70; two 10-horsepower motors for $406.70; one 2-horsepower motor for $56.70. The other bids were rejected. Bids for furnishing the aqueduct with a dredge pump and for riveted pipe were opened by the Board of Works a few days ago and have been turned over to Chief Engineer Mulholland for recommendation. The only bid for the dredger was from the United Iron Works of Oakland for $1400. Bids will be received by the Board of Public Works on July 16th for steam turbines, engines and electric generators for delivering 1000 kilowatts to the Los Angeles Aqueduct Cement Works, the equipment to be erected by the bidder.

ELECTRIC RAILWAYS.

Sacramento.—The State Board of Railway Commissioners is reported to be considering the advisability of appointing an agent to investigate the conduct of the various interurban electric railways throughout the State, with a view of preparing bills to be submitted to the Legislature, giving the Commission jurisdiction over such roads. In the opinion of the commissioners, the electric railways are similar to the steam roads and should properly be under their supervision.

Vacaville, July 9.—It is authoritatively stated that the Napa and Lakeport Railroad soon will have surveyors running lines for a road that will enter Lake County through this city and Yolo County and up Cache Creek. It is said that the route surveyed through Napa County into Lake County has proved unsatisfactory and that the purpose of the two months' extension which has been secured on rights of way bonded in Napa County is to allow the company to survey a new route from Napa Junction and Cordelia.

San Francisco.—The owl cars on all main lines of the United Railroads will be operated again, beginning with next week. This will mark the resumption of complete car service, if the United Railroads extends service on all lines until midnight, as is intended. The California Street line will operate cars at night as soon as the repair work at the lower end of California Street is finished. The cars are now running to Kearny Street. The Baker's Beach car line is being operated again by the United Railroads. Service will be continued only until 7 o'clock in the evening. The cars will run out Sutter Street to Presidio Avenue, and then out California and around Sutro Heights to the ocean beach. The San Mateo line, which has been running out Market and Valencia, has been changed back to Mission. Cars will operate under 15-minute headway, as in the former schedule.

TRANSPORTATION.

Hollywood, Cal.—Sealed bids will be received to August 12th for a franchise for an electric railroad along certain streets of this city.

San Diego, Cal.—Sealed bids are being received by the City Council for a franchise for an electric railroad along B Street in this city.

Los Angeles, Cal.—Sealed bids will be received up to August 5th by the City Council for a franchise for a double-track electric railroad along certain streets of Los Angeles.

Santa Monica, Cal.—The Hueneme, Malibu and Port Los Angeles Railroad Company has let an additional contract for the construction of five miles of railroad to W. K. Peasley .

Los Angeles, Cal.—The City Council has granted the petition of A. N. Davidson who asked that a franchise for an extension of the Tenth Street car line should be advertised for sale.

Torreon, Mex.—A syndicate of Chinese, headed by Dr. J. W. Lim, of Torreon, has been granted a concession by the Mexican government to build an electric railroad between Torreon and Matamoras.

Stockton, Cal.—The City Council has set July 15th as the day for the hearing of the application of the Central California Traction Company for a franchise for an electric railroad along certain streets of this city.

San Diego, Cal.—A concurrent resolution, adopted by the City Council at its last meeting, authorized the granting of a franchise to the Point Loma Electric Railroad Company for a loop line from Roseville to Ocean Beach.

Redondo, Cal.—A right of way through government land and other property between Redondo and San Pedro has been secured by H. E. Huntington. A coast line that will connect the two ports and link the Crescent Bay district with Wilmington and Alamitos Bay is in prospect.

Vallejo.—The officials of the Napa & Lakeport Railroad Company are at present seeking information as to the practicability of entering Lake County by way of Vaca Valley and Putah Canyon. This road starts at Tiburon and runs thence to Napa. The surveys for this portion of the road have been completed, but from Napa into Lake County the route is still undecided.

Fresno.—The survey of the Monterey, Fresno & Eastern Railroad Company between Monterey and Fresno has been completed and the work of building a wharf at the former city is being rapidly pushed in order to permit of the landing of material there for construction purposes. Condemnation proceedings have also been begun against land-holders in the vicinity of Fresno. The action of the company in withdrawing its application for a franchise in Fresno is thought to have been a move of the company to frighten property holders in this vicinity into thinking that the company might abandon its intention of entering the city.

Vallejo, Cal.—General Manager L. P. Perry of the Vallejo & Napa Valley Railroad Company is quoted as saying that the company will not extend a branch line from this city to Benicia, owing to the engineering difficulties. The road is being extended as far north as St. Helena and it is likely that Sonoma County will be tapped within a year if track materials can be secured. Manager Perry says that the road will touch Kenwood, Sonoma, Glen Ellen and Santa Rosa. Eight new cars of improved type, much on the plan of those in use on the Key Route System, and 9000 tons of steel rails are expected from the East in a few weeks for the extension of the line. The new cars will be fifty-six feet long, fitted with plate-glass observation windows, water coolers, and dressing and smoking rooms.

ILLUMINATION.

Auburn, Cal.—The Auburn Gas Company has had plans drawn for the main building for the new gas plant.

St. Helena, Cal.—H. M. Pitman, who has now purchased the property of the St. Helena Fruit Drying & Packing Company at Barro Station from A. D. Butler, will establish an electric plant at that point and will furnish St. Helena and Napa with electric light and power.

Yreka, Cal.—The Siskiyou Electric Light Company has been running its entire system during the past week from the Shasta River plant on account of the installation of new and more powerful apparatus at the Fall Creek plant on the Klamath River. When the new machinery is installed and in operation at the latter plant there will be sufficient current to permit of the extension of the company's transmission system throughout Siskiyou and adjoining counties.

An experimental gas turbine has recently been constructed in France, which showed an efficiency of eighteen per cent. The turbine is of the impulse type, the casing being lined with refractory material. Gasoline is used as fuel, and is fed under pressure through an expanding nozzle, being ignited electrically and generating a temperature of combusion of over 3000 degrees Fahrenheit. The blades were cooled to a certain extent, while rotating, by low-pressure steam admitted into the casing.

FINANCIAL.

Oakland, Cal.—The Roosevelt Oil Company has levied an assessment of five cents per share, payable in Oakland.

Bakersfield, Cal.—The Section Twenty-five Oil Company has levied an assessment of ten cents per share, delinquent July 30.

Marysville, Cal.—The Marysville and Nevada Power and Water Company has levied an assessment of one cent per share, delinquent August 10.

San Francisco.—The Truckee River General Electric Company will hold its annual meeting of stockholders on July 20 at the company's office in this city.

New York.—After fighting the State for years in an effort to avoid paying the State tax on franchises, the Western Union Telegraph Company has finally decided to pay the franchise taxes amounting to $50,000. The amount to be paid is for taxes accruing since 1900. The company raised the question of federal authority, contending that under the act of 1866 it was granted a federal franchise and that the State had no right to tax the corporation.

Redlands.—In a friendly suit that was instituted by the city of Redlands and its trustees against the city treasurer, A. E. Brock, the Supreme Court has rendered a decision affirming the validity of a bond issue of $50,000, the proceeds to be applied for the electric lighting of the city during the year 1907. The treasurer alleged that the bonds were illegal for the reason that the proceeds of the bonds were not to be used for purposes for which the city could legitimately issue bonds. The court holds that the treasurer must sign the bonds.

Los Angeles, Cal.—According to a decision handed down this week by Judge Olin Wellborn of the United States Court, after a hearing forced by the Home Telephone Company upon injunction proceedings, this city has the legal right to fix telephone, gas and electric lighting rates. The decision is a sweeping one and upholds every contention of the city attorney. It holds that the rate-fixing power may be delegated by the State to a city, in which case the city may proceed with all the authority and power of the legislature. In the case of the Home Company an ordinance was passed more than a year ago fixing service rates for business houses and residences.

According to government statistics, every person in the United States uses, annually, about $7 worth of electricity in some form. Trolley rides lead, $3 per capita. Electric light is second, $1.50 per capita. Every man, woman and child buys $1.25 worth of electrical apparatus and supplies, uses 75 cents' worth of telephone service, and 50 cents' worth of telegrams and fire alarms.

INCORPORATIONS.

San Francisco.—The United States Oil Company has been incorporated here with a capital stock of $1,000,000 by H. S. Woolner, M. E. Newmark and H. E. Woolner.

Oakland.—The Ferndale Lithia Water Company has been incorporated here with a capital stock of $50,000 by William R. Geary, Charles E. Thomas and George Schmidt.

San Francisco.—The Beatty Townsite Land and Water Company has been incorporated with a capital stock of $300,000 by E. S. Hoyt, A. A. C. Ames and George L. Keefer.

Fresno.—The Kreyenhagen Oil Company has been incorporated with a capital stock of $400 by Adolph Kreyenhagen, J. M. Robertson, Charles Kreyenhagen, P. F. Page and K. V. Phoenix.

San Francisco.—The Yellowstone Oil Company has been incorporated here with a capital stock of $1,000,000 by H. B. Guthrey, J. F. Riggins, Holmes Henshaw, A. G. Nichols, and Schuyler G. Tyron.

Los Angeles.—The Coast Range Oil Company has been reincorporated here with a capital stock of $1,000,000 in place of $10,000 as formerly. The directors are H. G. Gates, Joseph H. Call, and Frank H. Jackson.

Sonora, Cal.—The Sonora Gas Company has been incorporated here with a capital stock of $100,000 by Geo. Mundorf, E. L. Rehm, C. A. Belli, E. T. Gould, T. F. McGovern, W. A. Weidemann and W. L. McKinley.

San Francisco.—The Wilmington Oil Company of Arizona has been incorporated here with a capital stock of $250,000 by J. W. Brunton, Charles Strong, H. J. Robinson, F. S. Carey, A. J. Large, Oliver McCoy and J. P. Brunton.

Reno, Nev.—Articles of incorporation have been filed here by the Interurban Electric Railroad Company, which has a capital stock of $100,000. Of this amount $7000 has been subscribed by Walter Wright, Louis Berrum, J. L. Robinson, O. M. Clifford, George W. Perkins, John Guilding and W. F. Webster.

San Francisco.—The Union Water & Power Company has been incorporated here with a capital stock of $2,500,000, of which $1,990,000 has been subscribed by the incorporators. The directors are A. L. Pearce, 240,000 shares; J. D. Stewart, 120,000 shares; B. D. Adamson, 36,000 shares; J. L. Gould, 1000 shares, and C. H. Town, 1000 shares.

TELEPHONES AND TELEGRAPH.

Santa Clara, Cal.—The Pacific Telephone & Telegraph Company is preparing to improve its establishment here. It is given out that the office will be moved to new quarters in the Fatjo Building, soon to be built expressly for the company's use. It is also understood that new appliances will be installed.

TRANSMISSION.

Yreka, Cal.—John Macauley has appropriated 500 inches of water from Dutch Creek for electric power purposes.

Redding, Cal.—Former Secretaries W. D. Englebert and L. A. Bautier of the Pacific Power Company have been adjudged guilty of contempt by Judge Bush in Department Two of the Superior Court of this county. Mr. Englebert was fined $200 and Mr. Bautier $100, or they may serve out the fines at the rate of $2 per day.

Eureka, Cal.—H. L. Jackman and Henry Deering, of the North Mountain Power Company, have returned from Trinity County, where preparations are now being made for the erection of a power plant. The company has acquired an increased water supply and as a consequence will be able to command at all times of the year a water volume of 250,000,000.

Sacramento, Cal.—The Supreme Court has reversed a decision given by the Superior Court of Contra Costa County in the matter of the Hercules Water Company against B. Fernandez and has directed the lower court to sustain the defendant's demurrer. The company brought action to condemn a water right and land on Pinole Creek owned by the defendant. The appeal was taken on the grounds that the complaint was ambiguous.

Phoenix, Ariz.—The Harqua Hala Development Company, recently incorporated here, has chosen Captain F. S. Ingalls, president; S. S. Green, vice-president, and C. T. Bonny, treasurer. The company plans to develop extensive water power. A submerged dam 500 feet wide will be built at Point of Rocks and three miles of concrete tubing and a large amount of steel tubing will be put in. The capital stock of the company is $25,000. The company is controlled by the same parties as the Harqua Hala Water Company, also recently incorporated.

OIL.

Reno, Nev.—Six oil-well drillers from Southern California are at work less than three miles from Reno and in a few weeks they are expected to strike a rich flow of oil. They assert that they have good indications of oil. These men are in the employ of the Nevada Oil & Development Company, which is composed mainly of Californians, including President Henshaw of the Oakland Bank of Savings. The prospective oil field is about a half mile from the Southern Pacific Railroad and the oil could be piped by gravity to Reno and to the railroad for shipment.

FOR GAS COMPRESSORS see RIX C. A. & D. CO., S.F.

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Northern Electrical Mfg. Co.
Tel. and Elec. Equipment Co.

Electric Heating Devices
Johns-Manville Co., H. W.

Electrical Instruments
Cutter Co., The
Century-Klein Electric Co.
Fort Wayne Electric Works
General Electric Co.
Tel. and Elec. Equipment Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Co.

Electrical Machinery
California Electrical Works
Northern Electrical Mfg. Co.
Standard Electrical Works
Century-Klein Electric Co.

Electric Polishers
Northern Electric Mfg. Co.

Electric Railway Appliances
Pierson, Roeding & Co.
Johns-Manville Co., H. W.

Electrical Supplies
California Electrical Works
Century-Klein Electric Co.
Standard Electrical Works
Tel. and Elec. Equipment Co.

Electric Ventilating Fans
Century-Klein Electric Co.
California Electrical Works
Northern Electrical Mfg. Co.

Engines, Boilers, Heaters, etc.
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore, Chas. C. Co., Inc.

Electric Watchman's Clocks
Tel. and Elec. Equipment Co.

Engineers, Chemical
Smith, Emery & Co.
Moore & Co., Chas. C., Inc.
Standard Elec. Works
Tracy Engineering Co.
Westinghouse Machine Co.

Engines, Gas and Gasoline
Allis-Chalmers Co.
Henshaw, Bulkley & Co.
Moore & Co., Chas. C., Inc.
Westinghouse Machine Co.

Engineers and Contractors
Brooks-Follis Elec. Corporat'n
Byllesby & Co., H. M.
California Electrical Works
Cannon, Edward F.
Century-Klein Co.
Copeland, Clem A.
Doble Co., Abner
Cory, C. L.
General Electric Co.
Hunt, Dillman, Meredith & Allen
Jackson, D. C. & W. E.
Smith, Emery & Co.